UNIVERSIDAD COMPLUTENSE DE MADRID
FACULTAD DE CIENCIAS ECONÓMICAS Y EMPRESARIALES

TESIS DOCTORAL

An empirical analysis of the patterns of growth and convergence in the European Union since the introduction of the single currency

(Análisis empírico de los patrones de crecimiento y convergencia en la Unión Europea desde la introducción de la moneda única)

MEMORIA PARA OPTAR AL GRADO DE DOCTOR

PRESENTADA POR

Filippo Bonanno

Director

Rafael Myro Sánchez

Madrid

UNIVERSIDAD
COMPLUTENSE
MADRID

Doctorado en Economía

Facultad de Ciencias Económicas y Empresariales

AN EMPIRICAL ANALYSIS OF THE PATTERNS OF GROWTH AND CONVERGENCE IN THE EUROPEAN UNION SINCE THE INTRODUCTION OF THE SINGLE CURRENCY

(Análisis empírico de los patrones de crecimiento y convergencia en la Unión Europea desde la introducción de la moneda única)

Estudiante: Filippo Bonanno **Director: Profesor Rafael Myro Sánchez**

Index

Acknowledgments

I want to thank especially Professor Rafael Myro Sánchez for his availability and important advise during the development of the thesis. I want to thank Professor Emilio Cerdá Tena that accepted me into the PhD programme. I want to thank Matthias Firgo that taught me the application of econometric techniques for regional economic analysis during my fellowship at the Austrian Institute of Economic Research that relevantly contributed to improve the level of my thesis. I want to thank Professor Francisco J. Goerlich for his advises during my research stay at the Valencian Institute of Economic Research. I want to thank also Professor Francisco Javier Velázquez for his suggestions for the final version of the thesis. A special thanks to my family for the support during my studies.

Resumen

El proceso de convergencia que había caracterizado la historia de la integración económica europea comenzó a revertirse desde las primeras etapas del proyecto de unificación monetaria. En particular, el proceso de convergencia económica pasó de los países y regiones del sur de Europa a Europa del Este. Por lo tanto, durante las últimas dos décadas, los países y regiones de Europa del Este han estado reduciendo la brecha con las regiones más ricas, mientras que las brechas de ingresos y productividad entre los miembros "occidentales" de la UEM se ampliaron.

Esta tesis tiene el objetivo general de analizar y explicar empíricamente la evolución del proceso de convergencia en la Unión Europea desde la introducción de la moneda única desde diferentes perspectivas económicas. Mediante la aplicación de diferentes técnicas de econometría, individualizaré tres "fuerzas" económicas relevantes que contribuyeron al surgimiento de un camino bifurcado de convergencia en el ingreso per cápita y la productividad laboral en la Unión Europea.

La primera "fuerza" está directamente relacionada con la adopción de la moneda única que conllevaba reglas fiscales demasiado estrictas para los países que optaron por unirse al club. Algunos países periféricos resultaron particularmente penalizados por estas normas fiscales que también se aplicaron después de 2008 a pesar del brote de la Crisis Financiera Global.

La segunda fuerza está relacionada con la movilidad de los factores productivos que conllevó la progresiva reubicación de la industria manufacturera dentro y alrededor de las regiones europeas más ricas. La movilidad de factores productivos dentro del Mercado Común benefició notablemente a las regiones de Europa del Este, cuya posición geográfica es más estratégica para la inversión en la actividad de la industria manufacturera a fin de explotar los rendimientos crecientes. Simétricamente, el peso de la industria manufacturera se redujo en la mayoría de las regiones de los países periféricos de la Unión Económica y Monetaria.

La tercera "fuerza" está representada por la calidad de las instituciones gubernamentales. Las regiones de Europa occidental con instituciones gubernamentales de menor calidad son las regiones que también registraron los peores resultados económicos después de la introducción de la moneda única.

Abstract

The Convergence process that had characterized the history of the European economic integration started to reverse since the early stages of the project of monetary unification. In particular the process of economic convergence shifted from Southern European countries and regions to Eastern Europe. Therefore during the last two decades Eastern European countries and regions have been reducing the gap with the richer regions while the income and productivity gaps between the "Western" members of the EMU widened.

This thesis has the general objective to empirically analyse and explain the evolution of the process of convergence in the European Union since the introduction of the single currency from different economic perspectives. Through the application of different econometrics techniques I will individuate three relevant economic "forces" that contributed to the emergence a bifurcated path of convergence in income per capita and labour productivity the European Union.

The first "force" is directly linked to the adoption of the single currency that entailed too stringent fiscal rules for countries that opted to join the club. Some peripheral countries resulted particularly penalized by these fiscal rules that were also applied after 2008 in spite of the outbreak of the Global Financial crisis.

The second force is related to the mobility of the factors of production that entailed a progressive relocation of the manufacturing industry within and around the richer core European regions. Factor mobility within the Common Market remarkably benefited Northern and Central-Eastern European regions whose geographical position is more strategic for investment rate in manufacturing industry and increasing returns. Symmetrically the size of manufacturing industry shrank in most of the regions of the peripheral countries of the European Economic and Monetary Union.

The third "force" is represented by the quality of government institutions. Western European regions with lower quality of government institutions are actually the regions that recorded the worst economic performances after the introduction of the Single Currency.

General Introduction

During the preparation of the Maastricht Treaty of 1991, most of the academics shared the point of view that a sufficient similarity between the economies was necessary so that all the member states could prosper within the Economic and Monetary Union.

However what many countries considered essential for the access – e.g. fiscal discipline – was far from being a set of sufficient conditions in order to ensure that the EMU would have worked as it was supposed to (Stiglitz, 2017). As matter of facts, the *Maastricht criteria* focused extensively on *nominal* aspects of convergence such as monetary stability (price and exchange rate) and sound public finances while reserving little attention to the role of the real economic conditions such as labour productivity, institutions, economic structures and competitiveness. As a consequence, real convergence in income per capita has not occurred since the advent of the common currency (Franks et al, 2018).

As Ridao-Cano and Bodewig (2018) remark in a joint report published by the World Bank and the European Bank for Reconstruction and Development, since the early 2000s the European "*convergence machine*" has broken and an income and productivity divide is emerging across countries and regions of the European Union.

Although it is not possible to directly attribute to the introduction of the single currency the cause of the weak economic performances and the slowdown in convergence between the countries that firstly have joined the EMU, recent empirical evidences suggest that after the introduction of the Single Currency the convergence process in the European Union has bifurcated. The new Member States from Central and Eastern Europe (CEE) have been catching up in terms of income per capita and productivity. Within the Euro Area the South has diverged from the North, also due to the impact of the financial crisis (Gros, 2018). The fact that the "richer" Northern European members of the EMU have outperformed the "poorer" Southern members represents exactly the opposite of what the standard economic theory predicts.

Such a "bifurcation" in the patterns of growth and convergence *between* countries in the European Union has proceeded in parallel to a process of divergence observed between the core regions of Northern Europe and the peripheral regions of Southern Europe. Indeed, the path of regional growth and convergence between regions has followed the same path of the one observed between countries. As matter of facts, Alcidi et al (2018) estimate regional absolute beta-convergence in the period 2000-2015 and they show that the process of catching-up can be referred to as "*a tale of two speeds*". While most of the Eastern European regions have reduced to different extents their income gap with the EU-28 average income levels, many "Western" European regions within the EMU underperformed the EU-28. These underperforming regions are located in Spain, Italy, Portugal and Greece and remained poor or became even poorer relative to the EU-28 income per capita in 2001.

Therefore the general hypothesis of the doctoral research is that the group of countries that first joined the single currency no longer constitutes a "convergence club" as it did until the mid of the 1990s and its purpose is to empirically study the relevant determinants of the economic performances observed across European countries and regions since creation of the EMU, whose current members collectively add up the 73% of the GDP of the whole European Union (Eurostat data in 2019).

The thesis is structured in five chapters in which the different aspects conditioning economic growth and convergence across countries and regions within the EMU will be analysed with different econometric techniques and from different economic perspectives.

The results of this dissertation seem to be informative and capable to stimulate further empirical research, while promoting policy debate about the future of convergence across countries and regions in the Economic and Monetary Union.

As will appear clear, weak economic performances and the slowdown in convergence process are not theoretically directly and simply imputable to adoption of the Single Currency "*per se*" but rather such observed economic trends are the consequence of a mix of factors that will be widely explored in the body of this doctoral research. These factors encompass the government's permanent pursuit of fiscal consolidation or contractionary fiscal policy since the signature of Maastricht Treaty to nowadays (especially in the periphery of the UEM after the outbreak of the Global Financial Crisis), the tendency of manufacturing industrial activity to concentrate around the core European regions and weak quality of government institutions in most of peripheral countries.

The dissertation is structured as follows. In the 1st chapter I will test the hypothesis that since the intensification of the process of European economic and monetary integration and the EU enlargement towards East, the process of convergence has gradually shifted from Southern Europe to Central and Eastern Europe. First, I will provide an informative literature review about convergence and convergence clubs. Then I will conduct a long-term analysis of growth and convergence *between* the countries of the EU-15, most of which have joined the EMU during the period 1999-2001. In this chapter I will show that the Neoclassical Growth Model is capable to explain long-run economic performances observed in the "old" Member States of the European Union since the beginning of the process of European integration during the 1950s up to the end of the 1990s. In this overview about long-term convergence, I will show that in coincidence with the introduction of the Single Currency the process of "absolute" beta-convergence, that had characterised the story of the European integration, has completely reversed. Indeed the actual process of convergence in the EMU and in the EU after the mid of the

1990s has been driven mainly by the New Member States (henceforth NMS)[1]. This in-depth analysis of convergence in the EU serves as a starting point for further research developments in the next chapters of this doctoral thesis.

In the 2nd chapter I will restrict the focus of the study on the period comprised between the entry into force of Maastricht Treaty *nominal* convergence criteria in 1995 and the year 2018 (last available data). In this chapter I will analyse the role played by the monotonic budget discipline entailed by the EMU membership in the reversal of the convergence observed in the 1st chapter. In particular I will address the hypothesis that EU fiscal rules have been detrimental for growth in the "poorer economies" and thus for convergence within the group of countries under analysis. The results will be estimated with a Fixed Effect Model on a longitudinal panel dataset. The originality of this chapter relies on the fact that in the model I include an interaction term between initial GDP per Capita and the primary government balance in each time interval in order to verify the tight fiscal discipline entailed by the Maastricht Treaty and the EMU membership has actually contributed to undermine the process of convergence.

The results of this chapter have twofold relevance. On the one hand I empirically demonstrate that fiscal consolidation and austerity through the period 1995-2018 have exerted negative effects on economic growth and convergence within the Economic and Monetary Union whose actual member states long configured as a convergence club before the entry into force of Maastricht Treaty and the adoption of the Single Currency in 1999. On the other hand, these empirical results confute the hypothesis of "expansionary austerity" according to which fiscal consolidation is expected to have positive "non-keynesian" effects on economic growth and recovery through the expectations channel. The empirical evidence that the budget rules entailed by the adoption of the Single Currency have been detrimental for economic growth and convergence within the EU-15 explains also the observed reversal in the process of convergence since 1999 described in the 1st Chapter.

In the 3rd chapter I will analyse the effect of fiscal consolidation on regional economic growth and convergence within the countries of the EMU-12 during period 2007-2015. The results of the Multilevel Mixed Effects Model confirm the results of the 2nd chapter. Fiscal consolidation after the outbreak of the Global Financial Crisis exerted "keynesian" effects on regional economic growth and the drop in regional output associated to a percentage point of fiscal consolidation for peripheral economies is generally larger than the one estimated for the richer economies. Thus fiscal adjustment in the "Western" countries of the EMU during the period 2007-2015

[1] By New Member states it is meant the group of countries that comprises the Slovenia, Slovakia, Hungary, Poland, Czech Republic, Estonia, Latvia, Lithuania, Malta and Cyprus that accessed the EU in 2004 plus Bulgaria, Romania and Croatia that accessed between 2007 and 2013.

is a determinant of the shift of regional convergence from Southern Europe to Eastern Europe observed since the beginning of the 2000s.

Besides the strict fiscal discipline for government, the process of monetary and economic integration also implied the complete liberalization of the production factors (capital and labour) across countries and regions within a framework a progressive globalisation of the world economy. The process of monetary integration was also accompanied by the progressive enlargement of the EU that entailed the accession in the Common Market of 10 low income countries form Eastern Europe.

Therefore, starting from a *Kaldorian* theoretical framework in the 4th chapter I will analyse the process of industrial concentration that has followed the completion of the Common Market and the introduction of the single currency and lead to the emergence of a core-periphery pattern as envisaged by Krugman (1991a).

In particular I will test the hypothesis that the shift of convergence process form Southern countries of the EMU to CEE countries is also due to the shift of industrial manufacturing activity from the former to the latter regions. As matter of facts I will also show that regions that actually converged in terms of GDP per capita and labour productivity during the period 2001-2015 are those regions that recorded convergence in output per worker in manufacturing industry.

Three spatial econometric models developed in this chapter will show that investment rate in manufacturing is one of the driving forces of economic growth but, as showed by Álvarez López et all (2011), since the early 2000s the geographical distribution of manufacturing activity in Europe has been influenced by *location effects* that benefited regions with more market potential. Therefore the *location effect* of the agglomeration of the manufacturing activity can fully explain the bifurcation of economic growth both at country and regional level as mentioned above. This chapter contributes to the literature on regional studies by showing that, despite the shift from manufacturing industry to market services sector observed in all the advanced economies, manufacturing industry is still the engine of income and labour productivity growth. The results are very relevant also for policy-makers because confirm, among others, the analysis of Myro (2019) that urges a wider and more proactive industrial policy in the European countries, especially the Southern European ones, in order to contribute to the establishment of a new and more inclusive programme of economic growth.

Finally, in the 5th chapter I will analyse another aspect of the emergence of convergence/divergence paths on the basis of a post-2000 body of literature on economic growth and economic development as elaborated, among others, by Rodrik (2007 and 2004) and Chang (2010 and 2003). In this chapter I will provide an "institutional" explanation of the jeopardized regional economic performances observed in the "Western" European Union. The

results of the analysis will show that quality of government institutions is a remarkably relevant variable to explain the economic performances observed in the regions located in the "richer" members of the EU. This chapter contributes to the literature by analysing the relationship between economic growth and institutions with an "ex-post" approach based on a binary response model. The results of this analysis are also remarkably relevant from the policy-making point of view because show that one of the principal (and free of costs) structural reforms for the troubled regions to achieve economic growth and restore convergence would consist in improving the quality of government institutions.

As it is possible to deduce, explaining rigorously the emergence of processes of convergence and divergence across countries and regions of the EU after the introduction of the single currency it is neither a simple nor a straightforward task. The processes of convergence/divergence cannot even be analysed and explained by focusing on a single economic policy aspect because they are necessarily the outcome of a combination of causes. Therefore the relevance of this doctoral research lies on its comprehensive theoretical and empirical approach to the analysis of the economic trends observed since the mid of the 1990s in the European Union and in the EMU in particular.

Chapter 1

The past, the present and the future of economic convergence in the European Union

1.1 Introduction

After the Global Financial Crisis that evolved in a "Euro" crisis, many studies have questioned the possibility to observe convergence between the member states of the Economic and Monetary Union (EMU).

As Gros (2018:1) remarks, while there is no indication that euro area membership has had a negative impact on convergence between the "old" members, each of the 11 new member states form Eastern Europe, which joined the euro after 2004, have been converging at a slightly faster rate than one would have expected given their starting level of income per capita.

As already mentioned in the general introduction to this doctoral thesis, in this chapter I will test the hypothesis that after the Maastricht Treaty and the progressive stages of Enlargement towards Central and Eastern Europe, economic convergence shifted from Southern European countries of the EMU to the New Member States.

In particular I will put in evidence the relationship between turning points of the European economic monetary integration and the evolution convergence within the club of countries under analysis.

The theoretical framework to analyse convergence and economic growth here is the Neoclassical growth model as introduced by Solow (1956) and further developed in the literature (Mankiw et al, 1992; and Barro and Sala-i-Martin, 1992; Sala-i-Martin, 1996). The empirical evidence will show that convergence within the group of the "old" member states gradually faded away with intensification of the process of European integration until disappearing in coincidence of the introduction of the Single Currency and the progressive inglobation of CEE economies into the European Union.

1.2 Neoclassical Growth model and Convergence Clubs. A Review of the Literature

The argument of the neoclassical model that predicts that initial poor countries will grow faster than initially rich ones relies heavily on the assumption that the only difference across countries lies in their initial capital endowment per worker (Sala-i-Martin, 1992:1026).

This argument together with the assumption of diminishing return to physical capital forms the basis for the hypothesis "global convergence" in income per capita or output per worker when countries have access to identical technologies (Rodrik, 2013). In other words, in the long run countries are expected to convergence to a common steady state income or output per worker.

However, such strong conclusion derived from the theoretical model finds no empirical confirmation in the real world.

As matter of facts Baumol (1986) argued that convergence is not "*ubiquitous*" in the sense that it can be found only within given groups of countries. By analysing the evolution of growth in output per worker on Maddison's data he found substantial output per worker convergence between the industrialized economies between 1870 and 1970. Furthermore by restricting the period of analysis from 1950 to 1980, he documented that within a large sample of countries convergence had been taking place only between the richer economies. In a comment about the Baumol's paper, DeLong (1988) argued somehow pessimistic that convergence between countries could be observed only within samples constructed on a *selection bias* in the sense that convergence regression is run "ex post" for groups of counties that have actually converged.

At the beginning of the 1990s Chatterji (1992) found out that, with the exclusion of few successful cases, after two decades from decolonization most of the economic disparities between rich and poor countries had remained unchanged. Also Sachs and Warner (1995) find no tendency to convergence in the world economy from 1970 to 1989. The absence of "global" absolute beta convergence is also verified by Durlauf et al (2005) in a large cross-section sample of OECD, Asian, Latin American and African economies during the period 1960-2000. Convergence is also absent within the subsamples of developing economies. As matter of facts the authors within the sample also find out a tight positive correlation between initial income per capita (GDP per Worker in 1960) levels and income per capita levels (GDP per worker) in 2000. This essentially means that most of the poor countries had not reduced the income gaps with the richer ones during the period under analysis.

Given the lack of empirical evidence of global convergence, Durlauf and Johnson (1992) argue that cross-country growth is better explained with a model of local versus global convergence. Countries converge locally in the sense that "Western" economies with similar initial conditions tend to converge to one another while there is little evidence of convergence between economies with substantially different initial condition.

Therefore, while convergence within the group of OECD economies may be considered a realistic economic perspective, convergence of African or South American economies towards the OECD income levels may be considered unrealistic (Temple, 1999). Also Ben-David (1998 and 1997) finds out that convergence is observable only within the group of the richer economies that are member of the OECD.

For example Dowrik and Nguyen (1989) find evidence of the occurrence of a systematic process of convergence within the group of the OECD economies during the period 1950-1985. Convergence is also observable during the 1970s despite the occurrence of the two oil shocks with their destabilizing macroeconomic effects. Similar empirical evidences are found out by Mankiw et al (1992), which verify a significant tendency towards convergence is the sample of OECD economies over the period 1960-1985.

Also Larre and Torres (1991) confirm the evidence of convergence between the OECD economies during the period 1960-1990 and conclude that the accession in the European Community spurred economic growth in Spain and Portugal that remarkably reduced the income gap with the richer countries during the 1980s.

However, since the 1980s the convergence process within the OECD has slowed down with a few countries, including the US, experiencing acceleration in GDP per Capita growth and other countries lagging behind (Bassanini and Scarpetta, 2001).

Given this evident slowdown, it is possible to assert that long-run convergence observed within the group of the OECD is mainly the product of fast convergence rates observed during the 1950s and 1960s.

In order to address this empirical evidence of the slowdown in convergence process, Godea Rivas and Sanz Villaroya (2017) estimate a quantile regression model on the sample of the OECD economies and find out the evidence that the parameter representing the convergence hypothesis, despite being negative in every case, is higher in value and more significant as they advance to higher quantiles.

Restricting the convergence analysis to the "club" of original members of the European Union since the mid of the 1950s, it is possible to observe a gradual slowdown in the convergence process started at the beginning of the 1990s and culminated in the emergence of a process of divergence at the end of that decade.

Borsi and Metiu (2015) analyse convergence during the period 1970-2010 and their findings can be summarized as follows. First of all, there is no overall real per capita income convergence in the EU and this result is robust to any time horizon considered. Rather it is possible to individuate subgroups that converge to different steady-state equilibria. The authors also provide strong evidence in support of relative convergence but little evidence of absolute convergence within each cluster, pointing to the transitional nature of the period under analysis.

Shortening the period of analysis and focusing on the EMU, Croci Angelini and Farina (2016) test "absolute" beta convergence on a cross section of 12 countries in the period 1993-2012 and find out that the adoption of the Single Currency has not promoted convergence within the Euro Area.

Similar evidences of the absence of convergence between the original member states of the Economic and Monetary Union since the end of the 1990s are also outlined by Marelli et al (2019), Alcidi et al (2018) and Marelli and Signorelli (2016).

1.3 Testing the Human Capital Augmented Solow Model in the European Union

Taking the rates of saving and population growth as exogenous, the Solow model shows that the two variables determine a country's steady-state level of income per capita. As saving and population growth vary across

countries, different countries approach different steady states. The Model provides testable predictions. The higher the saving rate, the richer a country is. The higher the rate of population growth, the poorer the country is in terms of per capita GDP (Mankiw et al, 1992:407, henceforth MRW).

MRW extend the Solow Model to include human capital stock in the Cobb-Douglas production function and in its empirical estimation:

$$Y(t) = K(t)^{\alpha} H(t)^{\beta} (A(t) L(t))^{1-\alpha-\beta} \quad (1.1)$$

Where Y is output, K is capital, L is labour and A the level of technology as in conventional Cobb-Douglas production function. H is the stock of human capital (for the sake of brevity we directly consider these variables in per capita or per worker terms without showing the intermediate algebraic steps).

In MRW's version of the Solow Model, output per worker depends on the stock of physical capital, labour and the stock of human capital. In such a production function human capital can be interpreted as the level of professional knowledge and technical competences that can be acquired by the labour force through formal higher education and professional training. Given the fact that the model allows for decreasing returns to capital, the condition $\alpha+\beta<1$ is assumed.

MWR essentially estimate the following log-linearized equation derived from the Solow Model based on production function (1):

$$\text{Ln}\left[\frac{Y}{L}\right] = \ln A(0) + gt - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) + \frac{\alpha}{1-\alpha-\beta}\ln(s) + \frac{\beta}{1-\alpha-\beta}\ln(h) + \varepsilon \quad (1.2)$$

Where n denotes population growth, δ denotes the depreciation of capital and g denotes advancements in the level of knowledge. S and h denote saving to GDP and stock of human capital respectively. MRW assume polynomial $g+\delta$ to be the same across countries and equal to 0.05 and use the OLS estimator relying on the assumption that ε is uncorrelated with s and n.

Here I estimate the model for the samples of the EU-15 and EU-28 (excluding Ireland and Luxembourg) with cross sectional annual averages from 1970 to 2018 and from 1995 to 2018 respectively[2][3].

I assume natural logarithm of GDP per capita (and not the GDP per working age population as in MRW) in 2018 as the steady state or equilibrium income per capita. Given the fact that Eastern European countries started the

[2] Luxemburg and Ireland are not included because their GDP levels in 2018 configures as outliers that can distort the output of OLS estimation

[3] In Appendix 1.1 I will provide a description of the data utilized in this chapter and the source

transition to market economy only during the 1990s, remarkable differences in income per capita between Eastern and Western countries still persist despite the impressive rates of growth recorded by those economies. Therefore in model (b) I also add a dummy variable for the EU-15 countries in order to control for this West-East divide that characterized the enlarged EU[4,5].

The results are shown in Table 1.1.

Table 1.1

Dependent Variable: Log of GDP per Capita in 2018

	Sample: EU-15 countries 1970-2018 (exc. Luxembourg) (a)	Sample: EU-28 1995-2018(exc. Luxembourg) (b)
Ln (S/GDP)	.68***	.69***
	[.21]	[.20]
Ln (hc)	1.42***	1.45***
	[.30]	[.42]
Ln (n+g+δ)	.09	-.044
	[.29]	[.09]
EU-15	-	.96***
		[.11[
Constant	6.97***	5.88***
	[.65]	[.58]
R^2	.84	.90

*** Statistically Significant at 1%
Standard Errors in Parentheses [ ]

As it possible to note the coefficient estimates for saving and human capital are very similar in both the estimations. In the shorter-run analysis with the New Member states included in the sample, the coefficient estimate for the dummy variable EU-15 works as a watershed between the two groups of countries and shows that the average income per capita in the EU-15 is 96% higher than the average income per capita in the NMS. Both the estimations confirm the robustness of the Human Capital-Augmented Solow Model. Indeed, in both the groups of countries of the European Union, either in the long-run or in the shorter-run, saving and human capital explain the more than the 80% of the variation in income per capita across the countries of the samples[6].

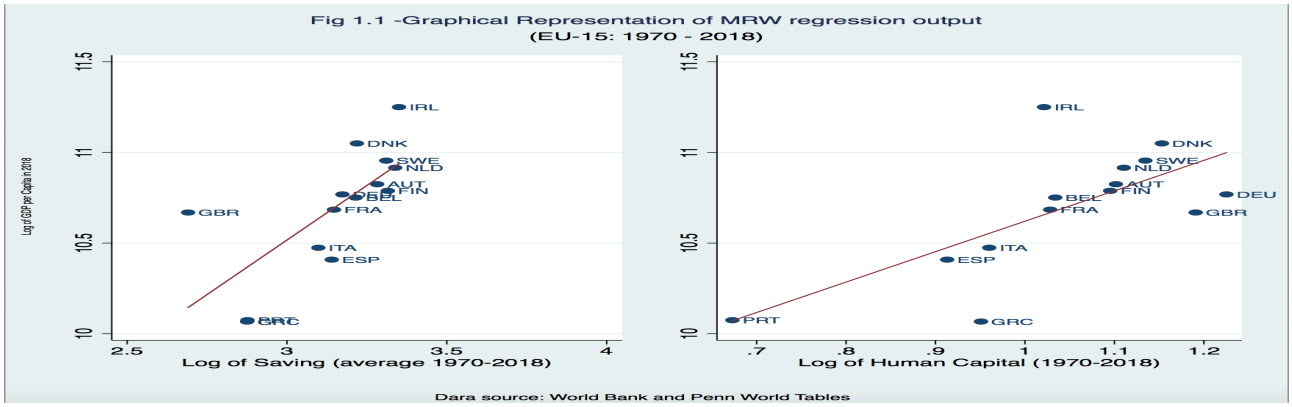
[4] EU-15 is the notation utilised by the OECD to denote group of countries in the European Union prior to the accession of ten candidate countries on 1 May 2004 and the further enlargements. The group comprises Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the United Kingdom.

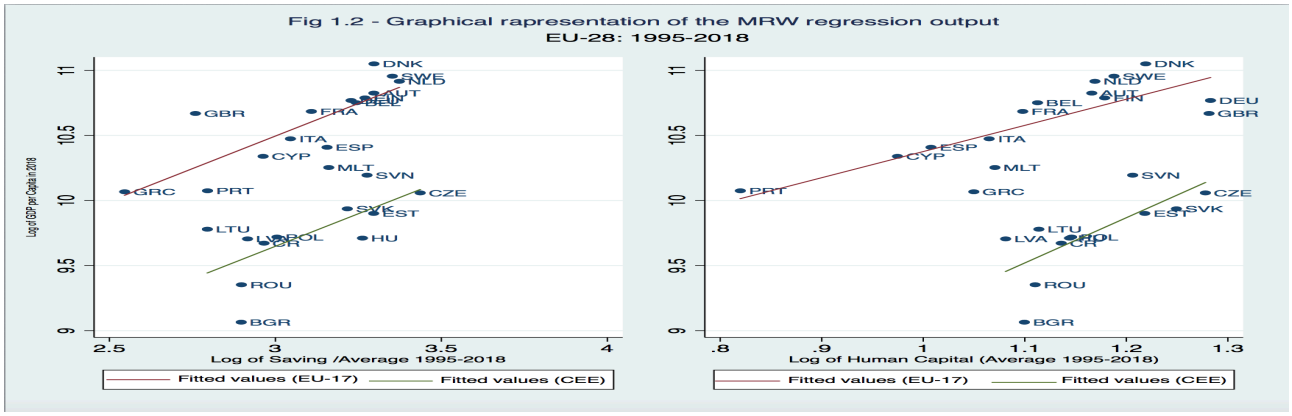
[5] When I refer to the group of EU-15 Luxembourg is always excluded by the sample because its income per capita represents a statistical outlier given also the rates of growth generally higher than the EU average recorded by the country

[6] Contrary to MRW in the regression I use saving rate and not investment rate, because in open economies high investment rates can be temporarily financed by the accumulation of foreign liabilities that can engine severe and destabilizing economic crises as in the case of Greece whose GDP drop cumulative by 25% after the Global Financial crisis. As matter of facts, during the most of the period analysed by MRW (1960-1985) capital movements across the countries were not completely liberalized neither in the OECD nor in the European Community. Furthermore, according to the empirical findings of Fendstein and Bacchetta (1991) and Feldstein and Horioka (1980), despite the progressive liberalization of international capital mobility, an increase in domestic saving is primary reflected in an increase in domestic investment in physical capital. Such a usually observable correlation is commonly known in macroeconomics as the "Feldstein-Horioka Puzzle". As also Deaton (1999:33) remarks, despite in an international economy investment in one country can be financed by saving elsewhere in the world, as matter of facts there is very high correlation between domestic saving and domestic investment.

Here it is possible to observe that elasticity of steady state GDP to human capital is higher than its elasticity with respect to saving rates (that in a Solow Model closed economy determines the accumulation of physical capital). Also MRW empirically observe that the steady state output is more elastic to human capital stock than physical capital in two of the three samples they analyse.

At the same time the coefficient estimate for polynomial ($n + g + \delta$) is not statistically significant despite taking on the sign predicted by the Solow Model and empirically confirmed in MRW. This strong positive linear relationship between per capita income levels and saving and human capital is shown in the Figures 1.1 and 1.2[7].





1.4 The Evolution of Absolute beta convergence since the beginning of the process of European Integration

Starting from the assumption of decreasing returns to physical capital within closed economies, the Solow Model predicts convergence conditional on a set of exogenous factors that hold constant the steady state, such as human capital, saving rates and population growth (Barro and Sala-i-Martin, 1992).

[7] In figure 1.2, the notation EU-17 denotes the group of EU-15 countries plus Cyprus and Malta that joined the EU in 2004 but had a much higher income per capita than most of the CEE countries

Besides adding control variables in the right-hand side of the regression in addition to the log of initial income per capita (or output per worker), another way to hold constant the steady state is to restrict the convergence study to sets of economies for which the assumption of similar steady states is not unrealistic (Sala-i-Martin, 1996). In other words this means to test convergence after an "ex post" selection of economies that have actually partially converged and configure as a convergence club as in Baumol (1986). In this framework, the farther an economy is from the common steady state, the faster is the rate of growth.

Therefore, absolute beta convergence occurs when, within a group of countries, poorer economies grow faster than the richer ones, thus experiencing a process of catching up in terms of income per capita or output per worker (del Hoyo et al, 2017).

From the econometric point of view, absolute beta convergence is detected when economic growth is regressed on the initial GDP per capita without controlling for any other variable and the coefficient estimate "beta" is negative and statistically significant.

The equation is usually specified as follows:

$$y_i = \alpha + \beta \ln(X_0) + \varepsilon \quad (1.3)$$

Where y denotes the average rate of economic growth observed in each country *i* during the period under analysis, X always denotes the GDP the beginning of the period and α and ε denote respectively the intercept and the random disturbance.

Assuming that the EU-15 countries configure as a convergence club or as a set of economies with similar steady states, I apply the model to the sample of EU-15 countries over different time intervals since 1951, the year in which the six Founding Members joined the ECSC[8]. As it is possible to note that average convergence rate between the European economies has gradually decreased, especially in coincidence of the turning points of the European economic and monetary integration occurred since the early 1990s.

The regression output is displayed in Table 1.2[9].

[8] The European Community of Steel and Carbon (ECSC) was established in 1951 with the Treaty of Paris signed by governments of Belgium, the Netherlands, Luxembourg, Germany, France and Italy

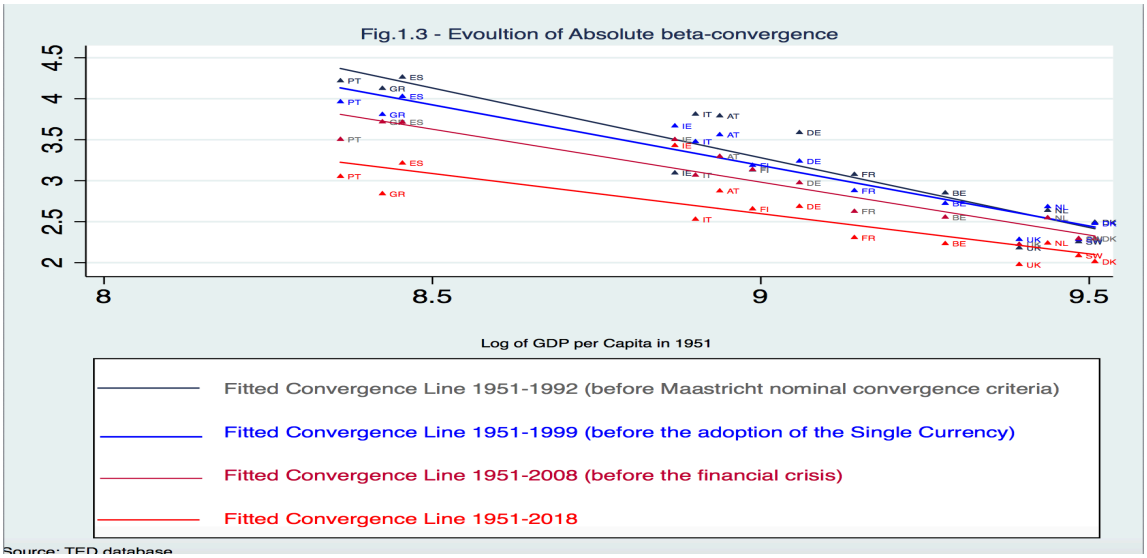
[9] In Appendix 2 I will provide the mathematical explanation of how Implied λ and the years needed to close half of the income gap (HD) are calculated

Table 1.2
Sample size:14
Dependent Variable: GDP per Capita Growth

	Natural Logarithm of GDP per Capita in 1951 (Beta-Convergence)	Intercept	R-Squared	Implied λ	HD	HD excluding Ireland from the sample
Convergence 1951-1992 (1)	-.0176*** [.001]	0.18*** [.017]	0.86	.029	22.22	23.02
Convergence 1951-1999 (1)	-.015*** [.001]	0.16*** [.01]	0.88	.026	26.65	26.86
Convergence 1951-2008 (2)	-.013*** [.0301]	0.14*** [.01]	0.86	.023	30.13	30.26
Convergence 1951-2018 (3)	-.0098*** [.001]	0.11*** [.01]	0.69	.013	42.09	47.97

***Statistically Significant at 1%

Figure 1.3 shows the graphical representation of the evolution of absolute beta convergence reported in Table 1.2.



As it is possible to note both in the regression output in Table 1.2 and in the Figure 1.3, the convergence fitted line has gradually flattened since the signature of Maastricht Treaty and the convergence rate detected during the period 1951-1992 is almost the double of the convergence rate estimated during the period 1951-2018.. Indeed, convergence rate observed before the Maastricht Treaty implied a quarter of century for a poor economy to close half of the income gap with the richer economies, while the convergence speed observed until 2018, thus comprising the period of the introduction of the euro, implies that it would take roughly half a century for a poor

economy to close half of the income gap with the common steady state income per capita of the richer economies.

Furthermore, when working on cross sectional data, OLS estimator cannot capture the evolution of the relationship between the variables over time and it is therefore obvious that the detection of absolute beta convergence over the period1951-2018 is essentially determined by the high rates of growth experienced by the poorer economies from the 1950s until the end of the 1980s.

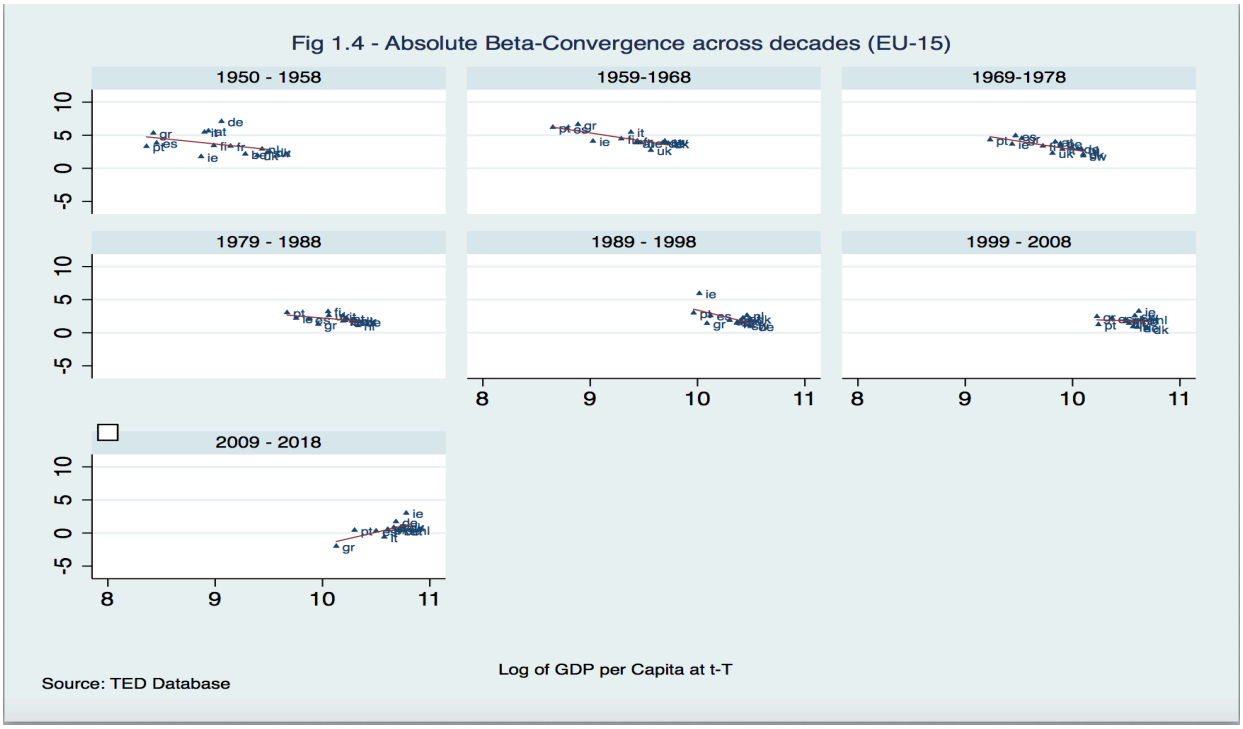
1.5 Has convergence definitely reversed in the EU-15 since 1999?

Given the limitation implied by the OLS estimator on long-run cross sectional data, in this section I will first analyse absolute beta convergence in the EU-15 across seven sub-periods of 10 years each form 1950 to 2018. Then I will estimate on a longitudinal panel dataset whether the introduction of the Single Currency has coincided with a reversal of the convergence process within the EU-15 group.

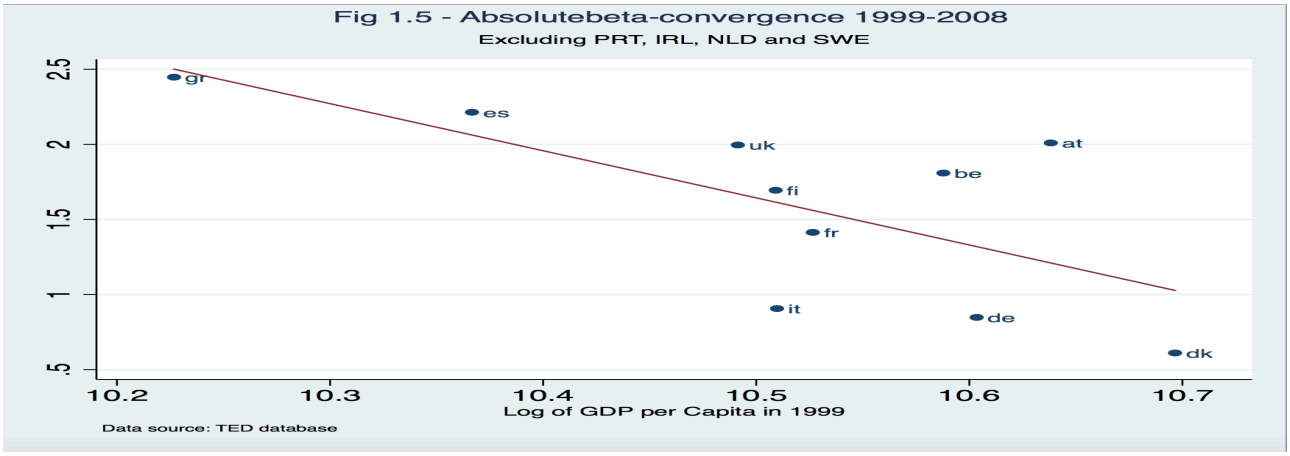
Results reported in Table 1.3 show that after three decades of sustained convergence, since the end of the 1980s convergence gradually disappeared.

Table 1.3	Sample size: 14	
10 years period	*Absolute β-convergence in GDP per Capita*	R-Squared
1950-1958	-1.67 [1.09]	0.16
1959-1968	-2.51*** [.53]	0.65
1969-1978	-2.54*** [.52]	0.50
1979-1988	-1.36** [.60]	0.29
1989-1998	-3.99*** [1.52]	0.36
Excluding Ireland	-1.12* [.51]	0.21
1999-2008	-.53 [1.39]	0.01
Excluding Ireland	-1.04 [1.17]	0.06
Excluding Ireland, Portugal, the Netherlands and Sweden	-3.31** [1.1]	0.52
2009-2018	+ 3.78*** [1.19]	0.45
Excluding Ireland	+3.10*** [.95]	0.48

***Statistically Significant at 1% ** Statistically Significant at 5% * Statistically Significant at 10%
Standard Error in Parentheses [ ]



Indeed, during the period of the implementation of the Maastricht nominal convergence criteria (1989-1998) a fast and statistically significant rate of convergence is detected only because of the presence of Ireland in the sample of countries. Indeed, if Ireland is excluded from the sample, the coefficient of convergence reduces remarkably both its "speed" and its statistical significance. Also during the period that goes from the adoption of the Single currency in 1999 to the spread of the global financial crisis in 2008, no convergence is detected between the countries of the EU-15. Convergence is detected within a confidence interval of 5% only if three countries of the EMU (Ireland, Portugal and the Netherlands) and one country outside the EMU (Sweden) are excluded from the sample (Fig. 1.5).



In addition to the slowdown or disappearance of absolute beta convergence within the whole EU-15 group during the decade 2009-2018 beta "convergence" coefficient takes on even a positive and statistically significant value, meaning that there was a statistically significant tendency of richer economies to outperform the poorer ones. Positive and statistically significant beta coefficient is also detected when Ireland is excluded from the sample, meaning that cross sectional divergence was not driven only by the uncommon rates of growth observed in a rich country like Ireland but was a generalized process of asymmetric growth that has emerged between the countries of the EU-15. Therefore it is possible to assert that, while the EU-15 configured as a convergence clubs in the Baumol's sense from the end of the 1950s to the end of the 1980s, after the Maastricht Treaty and adoption of the single currency a process of gradual divergence has started.

In order to further study the extent to which the introduction of the Single Currency has coincided with the emergence of a period of divergence within the EU-15, I specify the following longitudinal panel data model on 10-year non-overlapping averages:

$$\Delta y_{it}=\alpha_t + \beta_1 \ln(X_{i,t-T})+ \beta_2 (EMU_{it})+ \beta_3 (X_{i,t-T})^* (EMU_{it})+ \beta_4 (CRISIS)+\mu_{it} \quad (4)$$

(t-T=1950, 1959,..., 2009)

Where y denotes average per capita GDP growth during the time interval t=10. With this sampling strategy I obtain seven observations per sampling unit during the period 1950-2018[10].

Symbol α denotes the intercept of the regression. X denotes the GDP per capita at the beginning of each 10-year time interval. EMU is a dummy variable that takes on value 1 in the last two decades that coincided with the introduction of the single currency (1999-2008, 2009-2018) and takes on value 0 in the previous decades from 1950 to 1999 or if a country in the sample has not joined the EMU after 1999. CRISIS denotes a dummy variable that takes on value 1 during the time interval (2009-2018) and 0 in the previous time intervals. Symbol μ denotes the error term of the regression. The interaction term $(X_{i,t-T})^* (EMU_{it})$ is supposed to confirm if since the introduction of the single currency the process of convergence has been undermined or reversed as already estimated on cross sectional data over different decades.

Indeed if β_2 coefficient estimate is negative and β_3 coefficient estimate is positive it means that since the introduction of the single currency the poorer economies, that were supposed to catch up, actually lagged behind

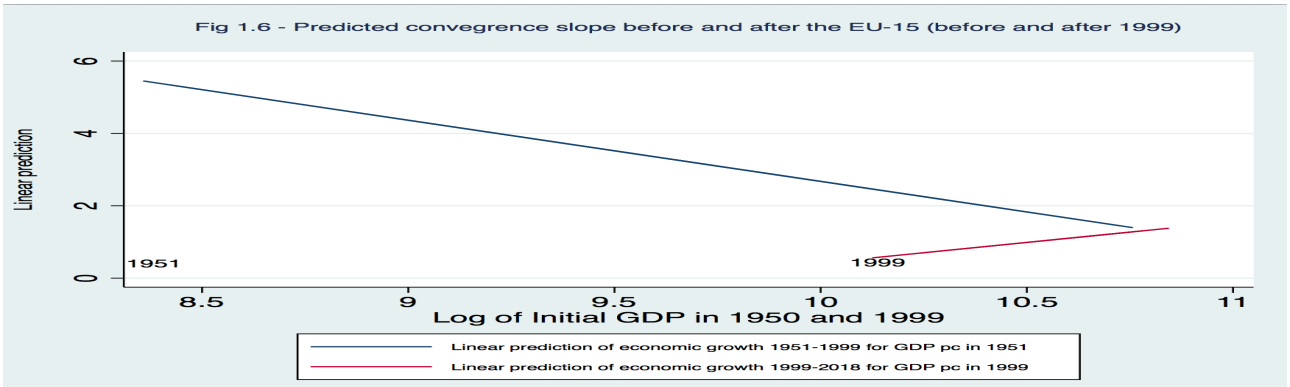
[10] In the first 10-year interval I calculate average growth in the period 1950-1958 (9 years) and I use the GDP per Capita in 1950 given the unavailability of data for the year 1948-49.

the richer ones. The Hasuman test suggests that random effect estimator is more appropriate than fixed effects estimator to infer the data in the sample. Table 1.4 reports the output to the model.

Table 1.4 Sample size:14	R-sq: Within = 0.57 Between = 0.67 Overall = 0.58
Log of GDP per capita at t-T	-1.69*** [.20]
EMU	-35.66*** [.16]
EMU* Log of GDP per capita at t-T	3.33*** [1.23]
CRISIS	-1.22*** [.36]
*Statistically Significant at 1% Standard Errors in Parentheses [ ]	Hausman test Chi2= 0.49 Prob> Chi2= 0.83

As the regression output shows, beta convergence conditional on the adoption of the Single Currency at a rate of 1.69% a year is observed overall within the sample since 1950. Thus around values similar to the absolute beta convergence (-1.5%) estimated on cross sectional data before the adoption of the Single currency as reported in Table 1.2. However if the focus is restricted to the variable "EMU" it is possible to observe striking empirical evidence. If dummy variable EMU takes on value 1, GDP growth decreases by 35.6% over the last two decades and the coefficient of convergence is reversed from -1.60% to +1,64% ($=\beta_1 + \beta_3 = -1.69+3.33$). A positive and statistically significant "beta convergence" coefficient for the last two decades means that after the adoption of the singe currency richer countries have grown faster on average than the poorer ones or can alternatively mean that, since the advent of the Single Currency, economic growth in the "poorer" countries has been undermined.

The reversal from convergence to divergence can be also shown graphically by plotting the relation with economic growth of the interaction between the GDP per capita and the introduction of the single currency as in Figure 1.5.



1.6 Convergence in the Enlarged EU

Since the introduction of the Single Currency, convergence between the original member states has not occurred. Rather convergence has been observed between the "old" member states of the EU and the NMS that accessed the EU after 2004[11]. As Cabral and Castellano-Sosa (2018) point out, while the financial crisis was undoubtedly harmful to growth in Europe, it reduced the gap in income per capita between the EU's members. This is explained mainly by the economic performances of richer members in the EMU like Italy who were not just the most affected but also the ones that recovered less rapidly.

In this framework, during the period 1995-2018 NMS drove the process of absolute beta-convergence in Europe both inside and outside the Economic and Monetary Union.

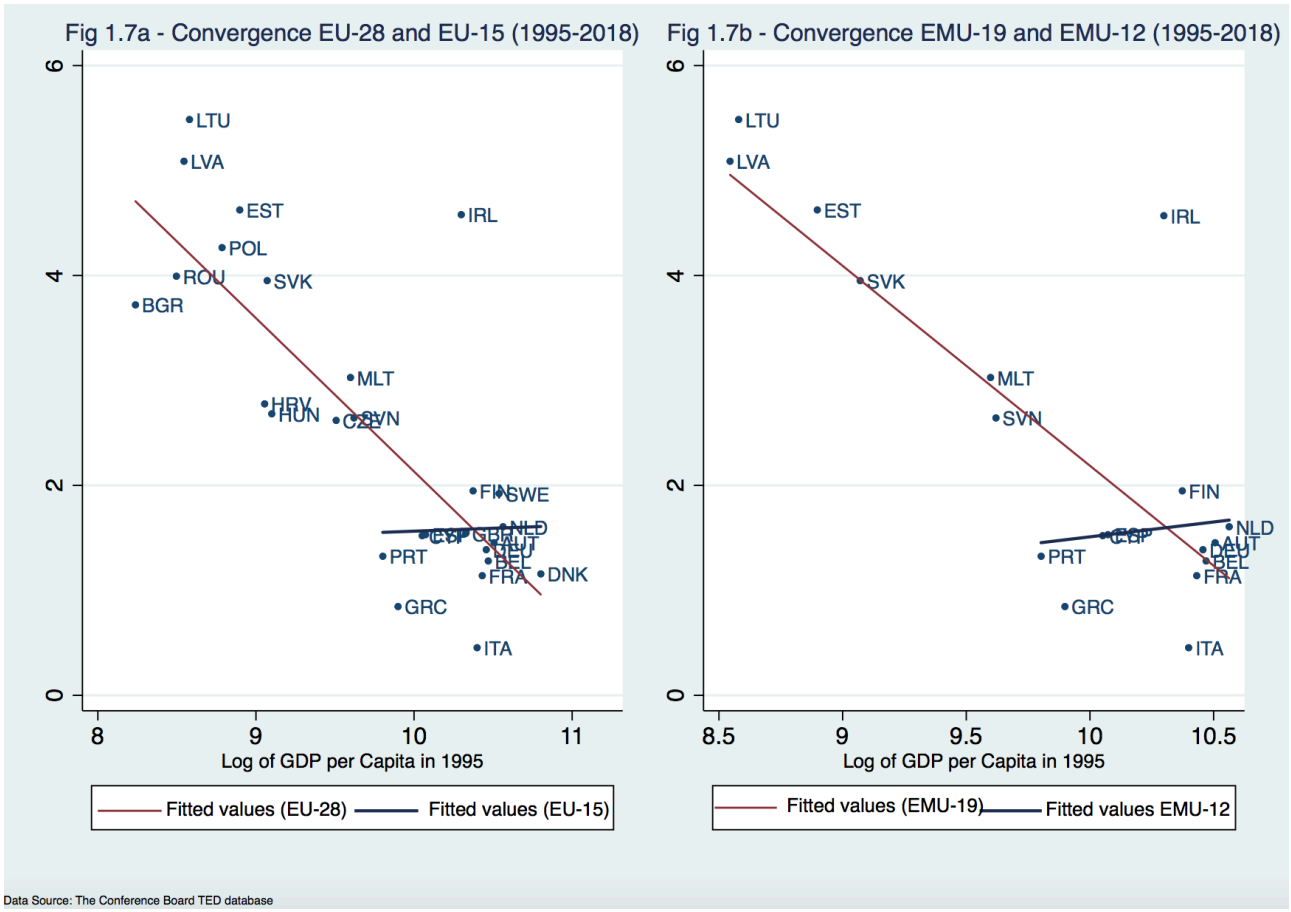
Table 1.5 reports the regression output of the absolute beta convergence estimated within the different subsamples of countries of the EU-28[12] during the period 1995-2018.

Table 1.5					
Dependent Variable: GDP per capita growth 1995-2018	EMU-12 (a)	EU-15 (b)	EU-28 (c)	EMU-19 (c)	EMU-19 exc. Ireland (d)
Log of GDP per Capita in 1995	.55 [1.34]	.27 [1.00]	-1.47*** [.24]	-1.90*** [.34]	-2.08*** [.38]
Constant	-4.25 [13.89]	-1.4 [10.44]	16.7*** [2.4]	21.23*** [3.45]	22.2*** [3.8]
R^2	0.01	0.006	0.60	0.64	0.66
Implied λ	-	-	.01813	.02498	.02738
HD	-	-	38.12	27.75	25.31
*** Statistically Significant at 1%					

Also the output of the absolute beta convergence regression, estimated on data related to the period 1995-2018, confirms the previous finding about the absence of convergence within the EU-15 since the advent of the Single Currency. On the one hand beta convergence coefficient takes on positive and not statistically significant values within the groups EMU-12 and EU-15 (1.5a and 1.5b). On the other hand, absolute beta convergence is observed in the EU-28 and in the enlarged EMU in particular, where it is possible to observe a convergence rate equal to -2.08%. A convergence rate equal to -2.08% a year means that it will take only 25 years for a poorer economy from Eastern Europe to close half of the income gap with the richer economies of the EMU.

Figure 1.6 (section b) shows the fitted convergence line in the EMU-19 (all member states of the Economic and Monetary Union) and in the EMU-12 (original member states).

[12] EMU-12 denotes the group of countries that adopted the Single Currency in 1999 plus Greece that was allowed to join the club in 2001. EMU-19 denotes the group of EMU-12 countries plus the Baltic States, Slovenia, Slovak Republic, Cyprus and Malta that joined the EMU at different stages after the first enlargement of 2004. EU-28 denotes the group of all the member states of the European Union. Luxembourg is always excluded from the samples.



As it is possible to note during the period 1995-2018 Baltic States recorded impressive rates of growth, outperforming all the countries of the EU-28, comprising Ireland. Also Slovakia (SVK) recorded remarkably high rates of economic growth. Symmetrically within the EMU-12 group Spain, Greece, Portugal, and Cyprus underperformed Finland and the Netherlands that in 1995 had much higher incomes per capita. Italy underperformed all the European countries in the sample.

1.7 Conclusions

In this chapter I applied the empirical strategy of MRW to test the Solow Model (augmented with Human Capital) on two samples of European countries, EU-15 and EU-28. The empirics confirm that the higher is the saving rate (or investment rate), the higher is the steady state GDP per Capita. The higher is the human capital, the higher is the GDP per Capita[13].

[13] The relevance of human capital for economic growth will be also confirmed in the next chapters

Then, relying on the strong assumption that the countries of the EU-15 have similar steady state incomes per capita, I analysed the evolution of absolute beta convergence since 1950 to nowadays. Empirical evidence shows three important facts.

First I showed that since the end of the 1950s to the end of the 1980s the EU-15 configured as a convergence club in which the hypothesis of a progressive convergence towards a common steady state income per capita was not unrealistic (Table 1.4).

Second I showed that since the intensification of the process of European economic integration, convergence speed has gradually reduced until disappearing (Table 1.3). Indeed during the period of the implementation of the Maastricht nominal convergence criteria (time interval 1989-1998), the rate of convergence remarkably drops if Ireland is not included in the sample. Indeed, when Ireland is excluded from the sample, despite keeping a negative sign, beta coefficient increases from -3.99% to -1.12% reduces its statistical significance at 10%.

The same tendency with negative but not statistically significant (neither at 1% nor at 5%) beta coefficient can be observed during the period 1999-2008, that is, during period of "stability" in the EMU before the spread of the Global Financial Crisis.

Convergence can be observed only when Sweden, the Netherlands, Ireland and Portugal are excluded from the sample (Fig 1.5). In this case it is possible to note that Spain and Greece have been the economies that actually converged towards the remaining rich members of the club in the time interval 1999-2008.

Then during the period between 2009 and 2018 that comprises the double-dip recession in Europe, the process of convergence completely reversed. As the output of Equation 4 shows (Table 1.4) after 1999 there has been a statistically significant strong tendency for the richer economies to outperform the poorer ones.

Third, I verified that within the EMU another convergence club has emerged between the rich countries (Benelux, Austria, Germany, France and Finland) and the New Member States that joined the single currency after their acceptance into the European Union (EMU-19). In this framework it is possible to assert that the catching up tendency shifted from peripheral countries of the EMU-12 (Italy, Spain, Portugal and Greece) to CEE countries that actually drove the process of convergence in the European Union, inside and outside the Economic and Monetary Union since the mid of the 1990s.

These empirical evidences leads to suppose that in the next future convergence inside the Economic and Monetary Union will be driven by the NMS from Eastern Europe, especially the Baltic States and Slovakia that recorded average rates of growth between 4 and 6% during the period 1995-2018.

Appendix 1.1: Description of the Data

Paragraph 1.3: The data to estimate the MRW model (Equation 2) are sourced from World Bank Database (GDP per Capita in 2018 and Average Saving Rates 1970-2018 and 1995-2018 and average population growth 1970-2018 and 1995-2018). Data for human capital are sourced from the Penn World Tables, the sole long run database for human capital available for all the countries.

Given the fact that data for 2018 were not available yet, I approximated the average 1970-2018 (and 1995-2018) as the averages of the period 1970-2017 (and 1995-2017).

I chose the World Bank database in order to build and work on a dataset in which at least three of the four variables used in the model were collected from the same source. GDP per capita is calculated and expressed in 2010 constant US$.

Paragraph 1.4 and Paragraph 1.5: Data for GDP per Capita and Rate of Growth of GDP per Capita are sourced from the Total Economy Database (TED) made available from the Conference Board. The choice of this source depends on the fact that it makes available data from 1950 for all the EU-15 countries in the sample because the objective of these two paragraphs was to study the evolution of absolute beta convergence since the 1950s. GDP per capita is calculated and expressed in 2018 constant US$.

Paragraph 1.4: Also in this case, data for GDP per Capita and Rate of Growth of GDP are sourced from the Total Economy Database (TED) made available from the Conference Board. GDP per capita is calculated in 2018 constant and expressed US$.

Appendix 1.2. Mathematical Steps to Calculate HD from β coefficient of Convergence

In Table 1.2, the Greek symbol *Lambda* (λ) denotes an nonlinear estimation of the speed of convergence linked to the time dimension t and it can be calculated following the mathematical steps proposed by Mankiw et all (1992) and Feldkircher (2006):

$$\lambda = (-\log (1+\beta t)/t) \quad (1)$$

Here equation 1 shows the linkages between the time dimension t with the coefficient of convergence β that has been estimated with OLS linear technique.

Once λ is calculated, it is possible to obtain the number of years needed for a "poorer" economy to close half of the gap to a common steady state income per capita with the richer countries through the following mathematical steps.

$$e^{-\lambda t} = 1/2 \quad (2)$$

$$-\lambda t = ln\frac{1}{2} \quad (3)$$

By dividing both sides of the equation by $-\lambda$, it is possible to obtain t as the number of years needed for an economy to close half of the distance in income (HD) to a common steady state (in the case of absolute beta convergence).

$$t = \frac{\ln(0.5)}{-\lambda} \text{ or } t = \frac{\ln(2)}{\lambda} \quad (4)$$

Chapter 2

Growth and Convergence in the Economic and Monetary Union in times of Fiscal Discipline

2.1 Introduction

Regression output in Table 1.5 (Chapter 1) shows that no-convergence has been observed within the EMU-12 or EU-15 since the mid of the 1990s. Given the fact that the mid of the 1990's coincided with the period of the entry into force of the Maastricht Treaty, in this chapter I will test the hypothesis that the strict fiscal discipline entailed both by the fulfilment of Maastricht criteria of public finance and then the EMU membership have contributed to reverse the process of convergence between the countries that joined the Economic and Monetary Union between 1999 and 2001.

This chapter contributes to the literature in two ways. First, I show that permanent fiscal consolidation and austerity, that in some countries got harsher in the aftermath of the Global Financial Crisis, can be identified as the major cause behind the divergence in income per capita observed since the mid of the 1990s within the Economic and Monetary Union. Second, I empirically confute, at least for the EMU countries, the hypothesis of "expansionary austerity" developed in a vast body of empirical literature that includes Alesina et al (2018 and 2015), Alesina and Perotti, (1996) and Giavazzi and Pagano (1996 and 1990).

Indeed during the period 1995-2018 the weakest economic performances among peripheral countries were observed in countries like Italy that recorded an average positive government primary balance (2.32%) larger than the ones observed in Germany (0.78%), the Netherlands (0.65%) and Austria (0.55%). Conversely, Spain and Portugal that during the same period recorded on average negative primary balances (-0.77% and -1.12% respectively) outperformed Italy. The empirical evidence extracted from the model confirms that European strict fiscal rules and austerity *per se* are harmful to economic growth and convergence.

2.2 Literature Review

Since Robert Barro's formulation of the "Ricardian Equivalence" in 1974, an extensive body of literature contrasted the "Keynesian" approach to fiscal policy and provided the empirical evidence that fiscal consolidation may have positive or "*non-Keynesian*" effects on income growth. At the same time an expansionary budget policy may have negative or neutral effects on economic growth. Indeed, if private sector regards budget deficit simply as taxes delayed it may increase its own savings to neutralize future taxation implied by the increased stock of public debt, thus offsetting government "Keynesian" budget policy (Tanzi and Zee, 1997).

For example Giavazzi and Pagano (1990), focusing on analysis of the cases of Ireland and Denmark during the 1980s, find out that when the consolidation of public finances is pursued through cuts to government expenditures it can have expansionary effects on the economy. Indeed, if fiscal consolidation is perceived by the

private sector as a signal that the share of government spending to GDP is being permanently reduced, households will revise upwards their estimate of their permanent income, and will raise currency and planned consumption (p.1)

Based on a panel dataset of 19 OECD countries with annual data collected for the period 1970-1994, Giavazzi and Pagano (1996) finds out also that a sharp cut in government consumption tends to be positively associated with an increase in private consumption when budget deficit or government consumption is very high. In the same paper the authors also find out that during the 1980s in Sweden consumption boomed coinciding with a substantial decline of government debt to GDP ratio.

Indeed fiscal consolidation may also signal that there will be substantial tax cuts in the future. By raising households' expected future disposable income and by increasing the confidence of investors, fiscal consolidation can thus stimulate private consumption and investment even in the short term, a phenomenon known as "expansionary fiscal contraction" or "expansionary austerity" (Guajardo et all, 2011:3).

Also Alesina and Perotti (1997) find out that government deficit and debt reductions in the OECD countries are "expansive" under certain conditions. The authors individuate two types of fiscal consolidation that exert opposite effects on economic growth. On the one hand, a first type of fiscal consolidation is achieved mainly through cuts on government expenditures on transfers, social security and wages and employment in the public sector. This type of fiscal consolidation has always an expansionary effect on economic growth for an economy. On the other hand, a second type of fiscal consolidation is pursued mainly through tax increases and it always has negative effects on economic growth. These empirical findings about the opposite outcomes of the different strategies of fiscal consolidation on economic growth are also confirmed in other studies. For example Alesina et al (2013) question the "conventional wisdom" according to which fiscal consolidation was the main culprit for the recessions experienced by many countries, especially in Europe. Analysing the response of economic growth to fiscal austerity in a sample of OECD economies (mostly from the European Union plus the US) during the period 2009-2013, the authors find out that there is a big difference between "tax based" and "expenditures-based" austerity. While former has always a negative impact on economic growth, the latter is at least always less costly.

Alesina at al (2014) further confirm these empirical findings by simulating the response of 16 OCED economies to different fiscal consolidation plans over a 30-years period. Adjustments based on expenditures cuts are much more durable and much less costly, in terms of output losses, than tax-based adjustment.

When some member states of the EMU started to experience solvency problems after the Global Financial Crisis because of speculative attacks on their sovereign bonds, Jürgen Stark as the German member of the Executive Board of the European Central Bank advocated against the ECB's sovereign bonds purchase and in favour of fiscal austerity (Reuters, 2011). Indeed, the long-run benefits of austerity measures could offset negative the demand effects via the channel expectations. In particular, the decline in the real interest rate induced by consolidation increases wealth by increasing the net present value of future income streams (Atkins et al, 2011). However, literature remains divided regarding the short-term and long-term effects of budget deficit reduction, and standard implication of Keynesian models is that cutting government spending or raising taxes has contractionary effects on aggregate demand and therefore on GDP growth (Guajardo et all, 2011).

Already in early 1992 after the signature of the Maastricht Treaty some concerns were raised about the compatibility of the stringent fiscal programs embedded in its rules with economic growth in most of the countries of the European Union[14]. Buiter et al (1992) in particular raised some issues about fiscal rules the countries had to comply with in order to be admitted into the EMU on the 1st January 1999. First, if the norms concerning public finance were to be taken seriously by governments (in particular the ones in the countries in with public debts and deficits above the Maastricht's implied limits), fiscal policy in the European Union (at time still named European Community) would have been subject to contractionary bias. In fact, the compliance of the norm of the Maastricht Treaty would have implied a multi-year sequence of tax increases and spending cuts for the European Community as a whole. Second, it seemed very likely that the impact effect on the level of economic activity of attempts to comply with the Maastricht convergence criteria would have been negative.

Among the costs of joining the EMU, also Obstfeld (1997:277) mentioned the likelihood that the EMU membership would have forced countries to cut their budgets in time of recessions or rising unemployment. In this aspect the EMU membership would have been destabilizing for the economies. Still during the transition from the Stage Two to Stage Three of the Monetary Union in 1998, Obstfeld (1998) observed that the deficit and debt limits established by the Maastricht Treaty, and reinforced by the Growth and Stability Pact (SGP) of 1997 to preserve the stability of the EMU financial markets, would have posed substantial difficulties on governments for economic policy and economic growth.

In fact, since the mid-1990s, when the process of implementation of the Maastricht criteria started, the EMU as a whole has recorded lower economic performance than the US both before and after the 2008 global financial crisis. In addition to this fact, in the same period it has been possible to observe also the emergence of a process

[14] The Article 104c of the Maastricht Treaty two rules of fiscal policy to allow a country to join the Economic and Monetary Union on the 1st January 1999:(a) Government budget deficit below 3% of GDP (b) Government debt below 60% of the GDP

of divergence in terms of GDP per capita among the countries within the monetary union. Also Marelli and Signorelli (2016), that analyse absolute beta convergence during the period 2001-2014 on the same group of countries, show that in the Euro Area there has not been convergence. Absolute beta convergence in the EMU can be observed only if the most recent members from Eastern Europe (Baltic states, Slovenia and Slovakia) are included in the sample.

De Grauwe and Ji (2013a) argue that such observed divergence between the "old" members of the EMU and the slow recovery of the Euro Area after the global financial crisis are mainly the consequences of the contractionary budgetary policies adopted in the European Union in compliance with the Growth and Stability Pact and its extension within the framework of the *Treaty on Stability, Coordination and Governance in the Economic and Monetary Union*[15]. According to the authors' calculations on a cross section of 11 "Western" EMU economies, one per cent fiscal contraction[16] has been cumulatively associated to a reduction of 1.38% in GDP per Capita growth during the period 2009-2012.

In an analysis of fiscal consolidation in advanced economies during the crisis, also Blanchard and Leigh (2016), find out that stronger plans of fiscal consolidation have been associated with rates of economic growth (or larger economic contractions) much lower than the ones expected by forecasters in the spring 2010 IMF World Economic Outlook, especially at the early stages of the crisis.

Fatás and Summers (2016) extend the analysis of Blanchard and Leigh (2016) over a longer horizon and confirm the negative relation between fiscal consolidation and both economic growth and potential output forecast. In addition the authors provide the evidence of strong hysteresis effects of fiscal policy, meaning that fiscal consolidation may exert permanent negative effects on economic growth in certain economies.

2.3 Data and Methodology

In this chapter I use both descriptive and inferential statistics. Descriptive statistics can be found in the paragraph 2.5 where I will provide a brief comparison of the economic performances between the Euro Area and the US and in chapter 2.6 where I will show the evolution of the relevant economic variables in the countries of the European Monetary Union during the period 1995-2018.

[15] The importance of the underlying budgetary position: the Stability and Growth Pact focuses more on improving public finances in structural terms (taking into account the effects of an economic downturn or one-off measures on the deficit). Member States set their own medium-term budgetary objectives. The Commission checks that the chosen medium-term budgetary objectives comply with the requirements set out in the Stability and Growth Pact. The goal is to improve the structural balance and converge towards the medium-term budgetary objective, by 0.5% of GDP a year as a benchmark. This provides a safety margin against breaching the 3% headline deficit target, with Member States, particularly those with debt levels over 60% of GDP, urged to do more in economically good times and less in bad times

[16] Here fiscal contraction is defined as the cumulative change in the structurally adjusted primary government budget from 2009-12

In paragraph 2.7 I will estimate a model on longitudinal panel data to quantify the effects of fiscal discipline on economic growth and understand whether the budget rules imposed by the Euro membership are harmful for convergence. The data are organized in the form of longitudinal panel dataset built on three years non-overlapping averages from 1995 to 2015, thus obtaining 8 observations for sampling unit.

Data related to economic growth and GDP per Capita utilized both in descriptive statistics and in the inferential model are sourced from the World Bank database. Data related to "fiscal consolidation" for European countries, namely primary balance as percentage of trend GDP, are sourced from AMECO database while the same indicator for the US is sourced from the OECD database. Given the fact that the data related to US federal primary balance are utilized only for descriptive statistics in the paragraph 2.5 and not for inferential statistics, it makes sense to source data for the same variable from different databases for comparison purposes. In the Appendix 2.1, data related to general government debt from 1992 to 2018 are sourced from the database FRED Economic Database made available from the Federal Reserve Bank of St. Louis.

The rest of the data (population growth and labour force education) utilized in the inferential model is sourced from World Bank database with exception of the already mentioned data for to primary balance (AMECO).

The longitudinal panel model is built with data collected from 1995 to 2018 for two reasons. The first is related to the availability of data for the variable of interest. Indeed, data for primary balance in the European countries in AMECO database are available from 1995. Second, 1995 represents the year in the mid between signature Maastricht Treaty in 1992 and 1st January 1999, the date by which countries had to satisfy the convergence criteria in order to qualify for the EMU membership. As also the data show, 1995 was the year in which government debt to GDP ratio started to decrease in most of the candidate countries, especially the most indebted ones.

Primary balance as percentage of trend GDP is chosen as a variable to indicate government fiscal policy stance as in almost all the most papers about fiscal consolidation and growth (Giavazzi et al, 1999; Alesina and Perotti, 1997 and 1996; Giavazzi and Pagano, 1997; McDermott and Wescott, 1996).

2.4 The Rationale for Tight Budget Policies in the Economic and Monetary Union

When the Euro was started a fundamental stabilizing force that existed at national level was taken away from the countries as the lander of last resort function of the central bank. In this new monetary system, member countries of the European Monetary Union have started to issue government bonds denominated in a currency they exerted no control over. As a result, governments of these countries could no longer guarantee that the cash

would always be available to roll over the government debt (De Grauwe and Ji, 2015:2). In this framework, the capability of Euro Area member countries to withstand adverse macroeconomic and financial shocks was identified as the major challenge for the success of the Euro (Lane, 2012). In fact, the Maastricht Treaty explicitly made prohibition to the European Central Bank and the central banks of the Eurosystem to grant credit facilities or loans to "*central governments, local or regional or other public authorities and other bodies governed by public law*" (Art. 104.1 of the Maastricht Treaty)[17].

This commitment for market discipline for government was also reinforced by the *no bail out clause* according to which a country in financial troubles could not be granted with financial support by the other member states of the Economic and Monetary Union.

These rules were essentially asked by Germany and Northern European countries in order make sure that the Economic and Monetary Union would configure as an anti-inflationary area. Therefore the institutional architecture of the Economic and Monetary Union had essentially to reflect German preferences about "hard-nosed" central bank over "wet government" (De Grauwe, 2016). In this framework, sound public finances would have preserved countries from sovereign debt crisis likely to affect the other economies of the EMU through the banking system and financial markets and shielded the European Central Bank from national governments' pressures in favour of accommodative monetary policy.

In this kind of monetary system large positive primary government balances become the major determinant of public debt sustainability.

The budget constrain of government can be expressed with the following equation:

$$\dot{b} = (g - t) + (r - x)b - \dot{m}$$

(2.1)

Where $\dot{b}$ is the evolution of debt to GDP ratio (b/G), g is the ratio of government expenditure to GDP (G/Y), t is the tax revenue, r is the interest rate on government debt and x denotes the rate of GDP growth ($\dot{Y}/Y$). $\dot{m}$ denotes the growth of monetary base (M/Y).

The equation (1) can be interpreted as follows. In a context of negative balanced primary budged ($g - t < 0$), if the interest rate on government debt exceeds the rate of economic growth, government debt increases

[17] "Overdraft facilities or any other type of credit facility with the ECB or with the central banks of the Member States (hereinafter referred to as "national central banks") in favour of Community institutions or bodies, central governments, regional, local or other public authorities, other bodies governed by public law, or public undertakings of Member States shall be prohibited, as shall the purchase directly from them by the ECB or national central banks of debt instruments." (EC Treaty, Art. 104)

indefinitely. The dynamics of debt accumulation can be stopped only if the primary budget deficit is reversed into a sufficiently large positive primary balance (t-g>0) or with money creation (De Grauwe, 2016; Marelli and Signorelli, 2010). Given the European Central Bank's strict anti inflationary policy mandate and the "constitutional" constraints on government bonds purchases to bring down interest rate in a framework of "one size fits all" monetary policy, governments in the EMU can stabilize and reduce high public debts only by running suitable large primary surpluses (De Grauwe, 2016).

2.5 Economic performances in the Euro Area and in the US

From 1995 to 2018 the EMU as an aggregate recorded an average primary budget equal to 0.5% while for example the US recorded an average primary balance equal to -2.51%.

This difference in budgetary policy between the two continental economic areas has been accompanied by relevant differences in economic performances over the same period. As it is possible to note in Figure 2.1, the US remarkably outperformed the Euro Area.

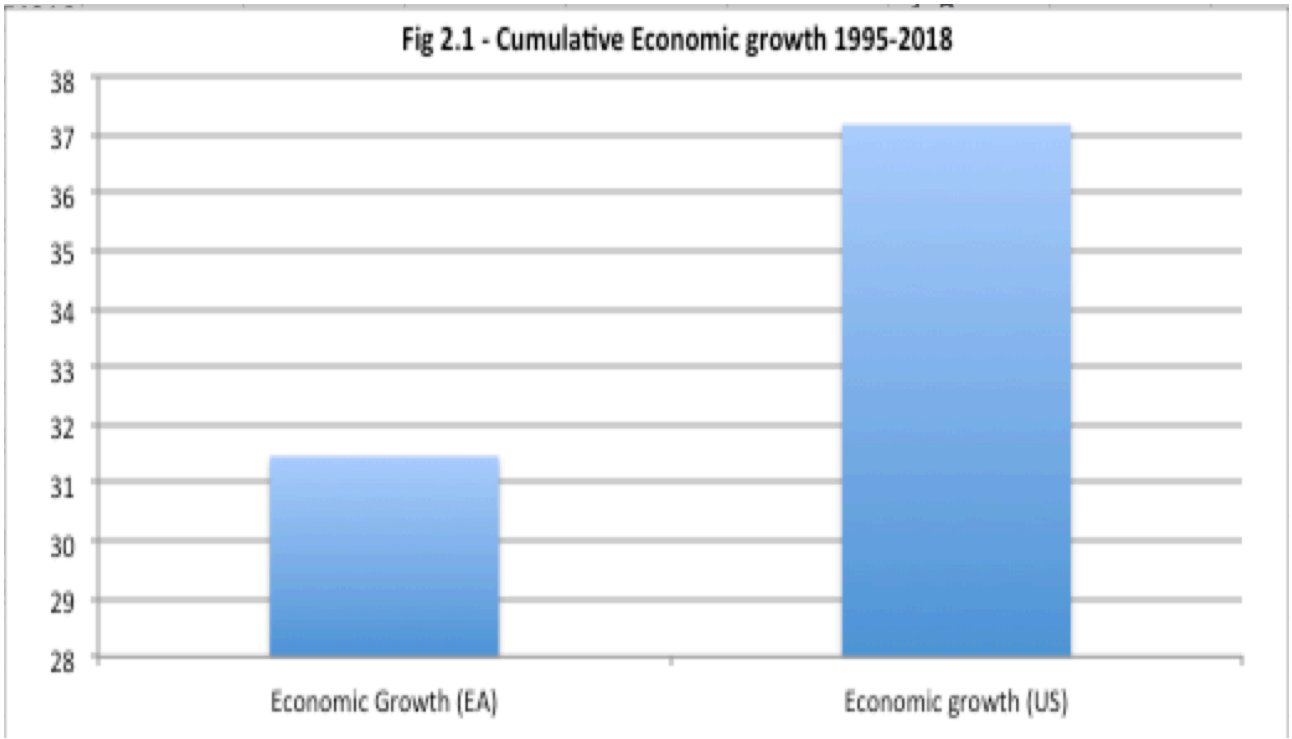
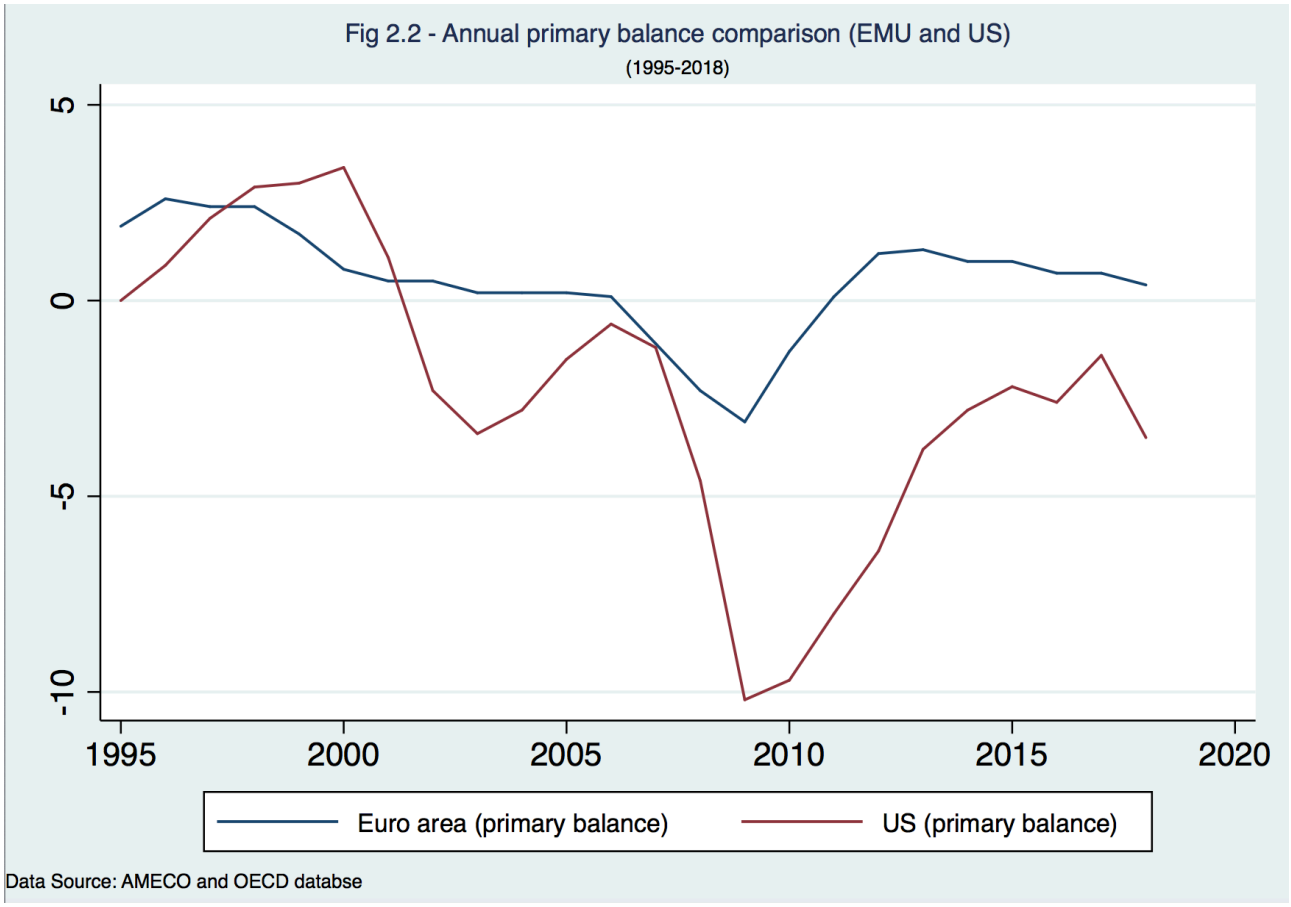


Figure 2.2 shows the annual data of the Euro Area aggregate primary balance and the one of the US federal government in the period 1995-2018[18].

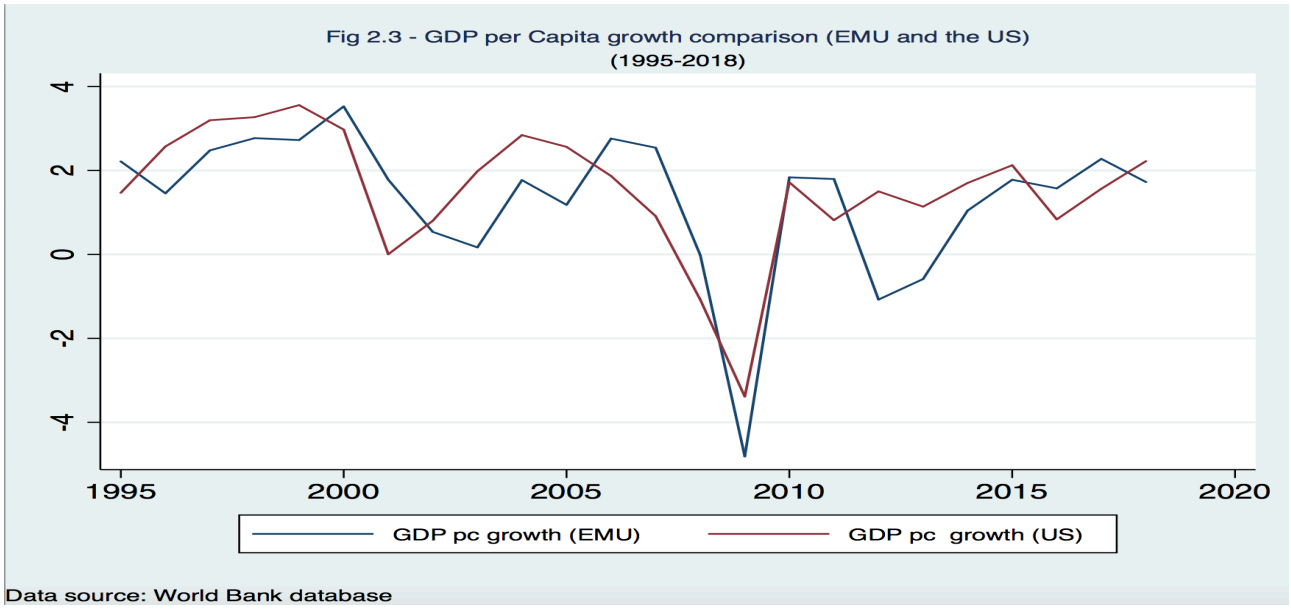
[18] The variable primary balance is the government balance excluding interest payments and it is calculated as (g-t)/trend GDP



As it is possible to note since the early 2000 US governments let the primary balance progressively deteriorate while the aggregate primary balance in the Euro Area remained in equilibrium until 2007. When the global financial crisis hit the economies, the Euro Area policy-makers opted to contain primary deficits through the imposition of fiscal austerity while the US federal government opted to pursue expansionary budget policies by allowing the primary balance to drop from -4.6% in 2009 to -10.2% in 2009. In 2011 the aggregate primary balance of the Euro Area was in equilibrium (equal to 0.1%) and the US federal primary balance was equal to -8.4%.

The speed with which most of countries of the EMU (and thus the aggregate Euro Area) have brought back the primary balance into surplus after the Great Recession of 2008-2009 has been acknowledged as the main cause of the second wave of economic crisis experienced in Europe in the period 2011-2013. As Heimberger (2016) finds out, the depth of economic crisis and the double dip recession in the Euro Area economies during the period 2011-2013 have been closely related to the harshness of fiscal austerity.

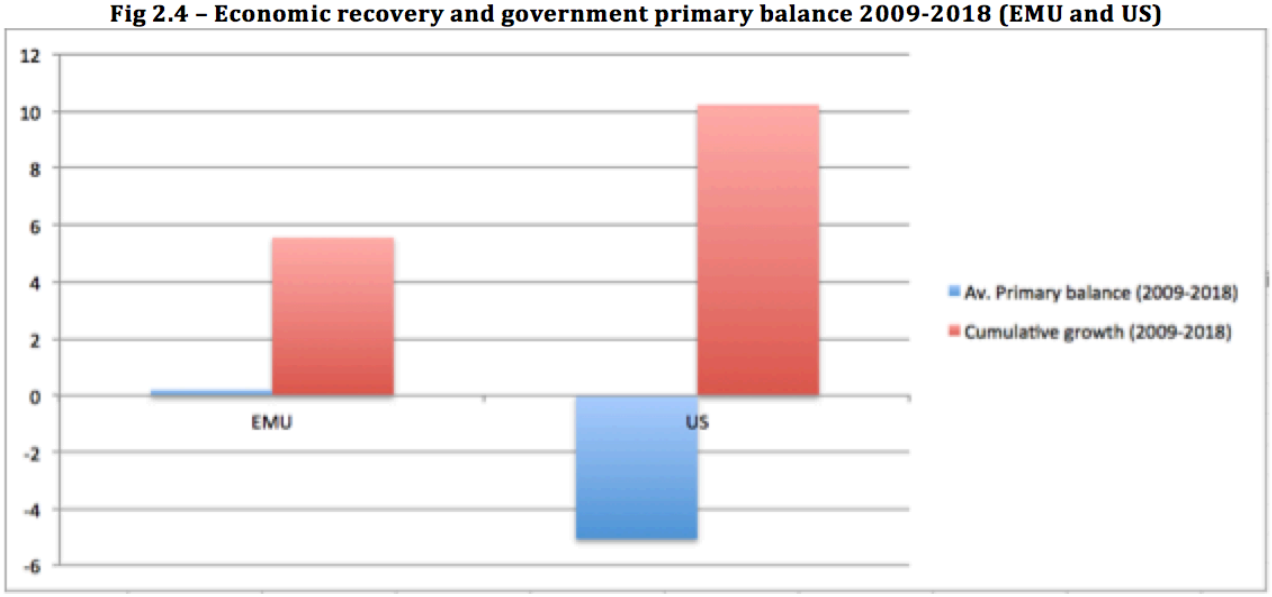
The figure 2.3 shows the comparison of the annual economic performances recorded in the Euro Area and the US in the period 1995-2015.



As it possible to note, the economic activity started to slow down in the US where the financial crisis was originated. However, the drop of GDP in 2009 was much more steeper in the Euro Area than in the US that undertook a plan of expansionary fiscal policy. Furthermore after 2010 the US, that implemented expansionary budget policy, came back to stable economic growth while the Euro Area economic activity experience another slump in conjunction with fiscal consolidation that was pursued with different levels of intensity as a policy objective in all the countries of the Economic and Monetary Union.

Figure 2.4 summarizes the post-2009 primary budget policies and economic performances occurred in the Euro Area and in the US.

Fig 2.4 – Economic recovery and government primary balance 2009-2018 (EMU and US)



As it possible to note, cumulative growth observed in the Euro Area whose primary government balance was in equilibrium in the period 2009-2018, was roughly the half of the cumulative growth observed in the US whose negative primary balance was on average equal to roughly -5% during the period under consideration.

2.5 Primary balance, economic growth and government debt. Stylized facts in the European Monetary Union

Butier et el (1992) provide an overview on the government finance statistics across the signatory countries of the Maastricht Treaty.

In 1992, the year of the Maastricht Treaty, many candidate countries did not satisfy the guidelines about government deficit and debt.

Table 1 reports the descriptive statistics of government debts, government budget and primary balance in the signatory countries of the Maastricht Treaty at the end of 1992[19].

Table 2.1

	Gross Public Debt as share of GDP in 1992	Government Budget as share of GDP in 1992	Government Primary Balance as share of GDP in 1992
Belgium	129.6	-5.9	5.4
Denmark	65.8	-2.1	5.2
Germany	48.7	-3.4	-0.6
Greece	99	-13.2	-0.5
Spain	46.4	-4.3	-0.5
France	47.5	-2	1.3
Ireland	100.4	-2.5	5.8
Italy	103.9	-9.9	0.7
Luxembourg	6.4	2.6	3.1
Netherland	79.5	-4.0	2.2
Portugal	62.7	-5.4	3.0
United Kingdom	45.6	-4.9	-1.6

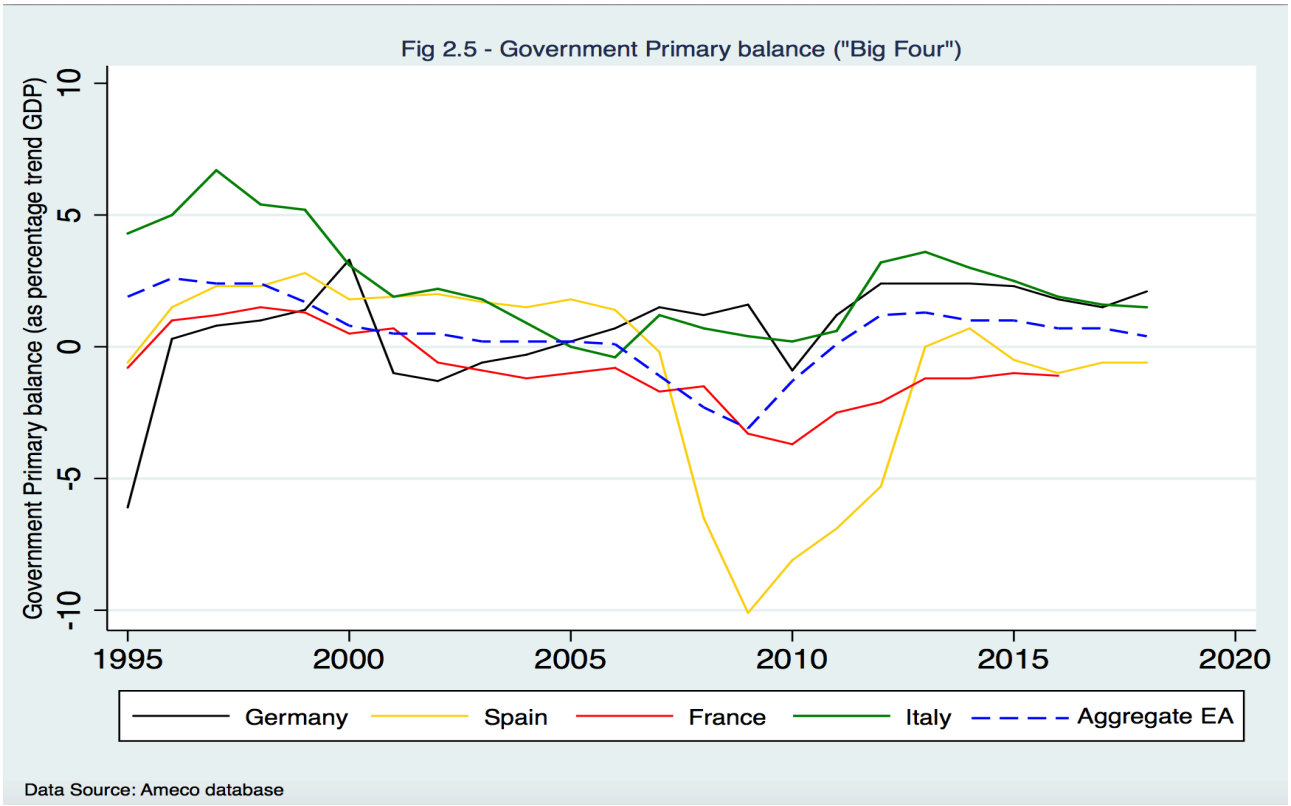
Data sourced in Buiter et al (1992)

As it is possible to note most of the candidate countries in 1992 recorded positive or negligibly negative primary balances (excluding the UK) meaning that most of the budget deficit was determined by high interest rates expenditures on government public debt in the framework of the European Monetary System (EMS) as in the case of Italy, Greece, Belgium, Portugal and Ireland.

[19] Despite signing the Maastricht Treaty in 1992, the UK and Denmark opted-out of the Single Currency

In this framework candidate countries, that committed to qualify for the EMU membership on the 1st January 1999, started to implement a mix of cuts to government expenditures and tax in order to slash budget deficit and satisfy the Maastricht convergence criteria on the 1st January 1999 (Savage, 2001).

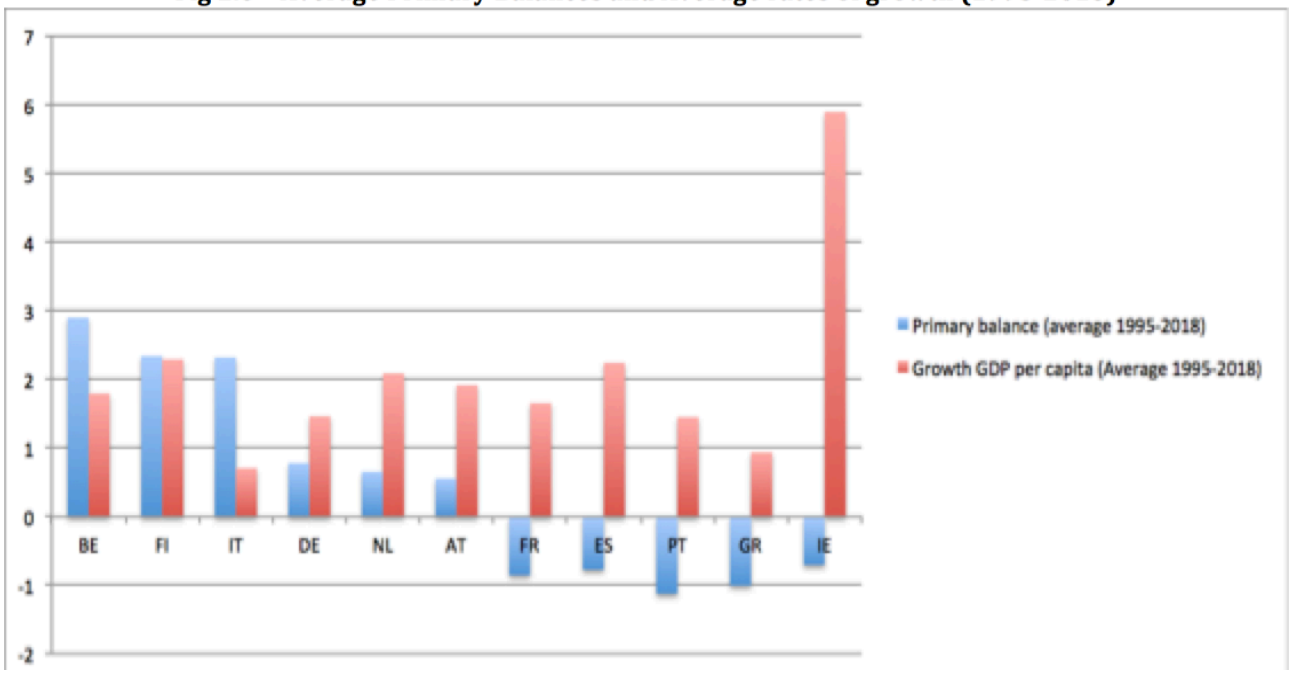
Figure 2.5 shows the evolution of annual government primary balance in four largest economies of the EMU during the period 1995-2018.



As it is possible to note, among the "big four" Germany and Italy were the countries that recorded primary balances above the one observed in the aggregate Euro Area. Spain recorded generally negative primary balance below the aggregate Euro Area primary balance since 2008 onwards while France recorded negative or below Euro Area primary balances since 1995

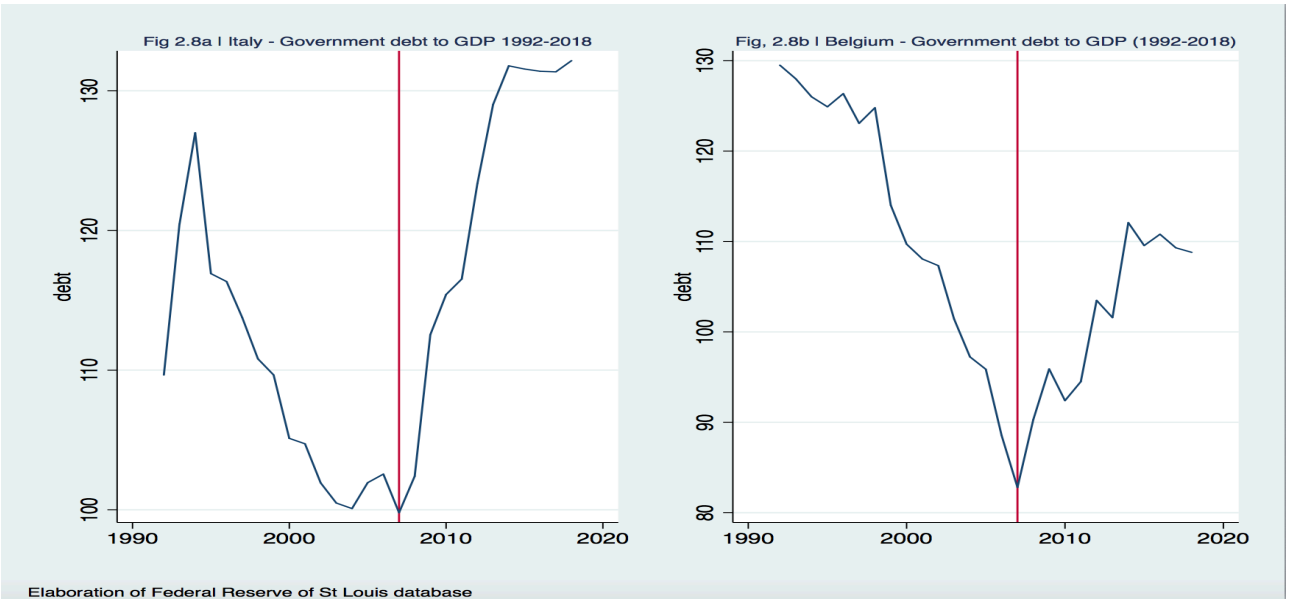
Figure 2.6 reports the bar chart of average rates of growth and government primary balances observed across the original member states of the Economic and Monetary Union.

Fig 2.6 – Average Primary Balances and Average rates of growth (1995-2018)



As it possible to note, Italy was the country that recorded the larger average government primary balance of the group of "big fours" over the period 1995-2018. At the same time France recorded negative average government primary balance as Spain, Portugal, Greece and Ireland.

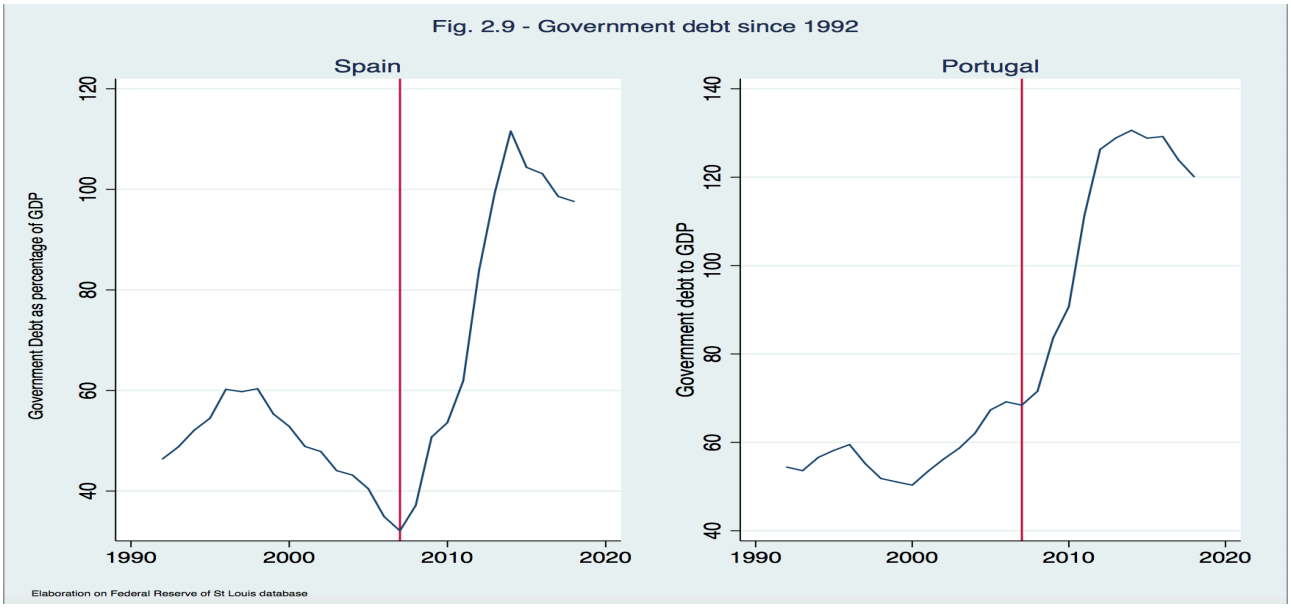
Given the determination to form part of the first group of countries that would have joined the Economic and Monetary Union on the 1st January 1999, since 1995 a dramatic reduction of government debt was observed in many countries, especially in the ones that had started the transition with very large debts like Belgium and Italy (Fig. 2.8a and 2.8b).



Since the mid of the 1990s until the 2007/08 crisis, Italy and Belgium (the countries that have recorded the large government primary surplus together with Finland) were seriously committed to government debt reduction. As it possible to note government debt at the end of the 1990s had dropped by more than 20 percentage points in both the countries with respect to the levels observed in the early 1990s.

However the path of debt reduction was interrupted by the breakout of the Global Financial Crisis that resulted in an abrupt increase in government debt as percentage of GDP, especially in Italy where the ratio in 2013 exceeded the levels observed in the early 1990s. Given the positive or generally non-negative primary balance observed also during the height of the Global Financial Crisis and the sovereign debt crisis (2011-2013) it is possible also to assert that the new explosion of government debt in Italy was basically provoked by the relevant increase in interest rates on government bonds and the consequent increase in the expenditures for debt servicing.

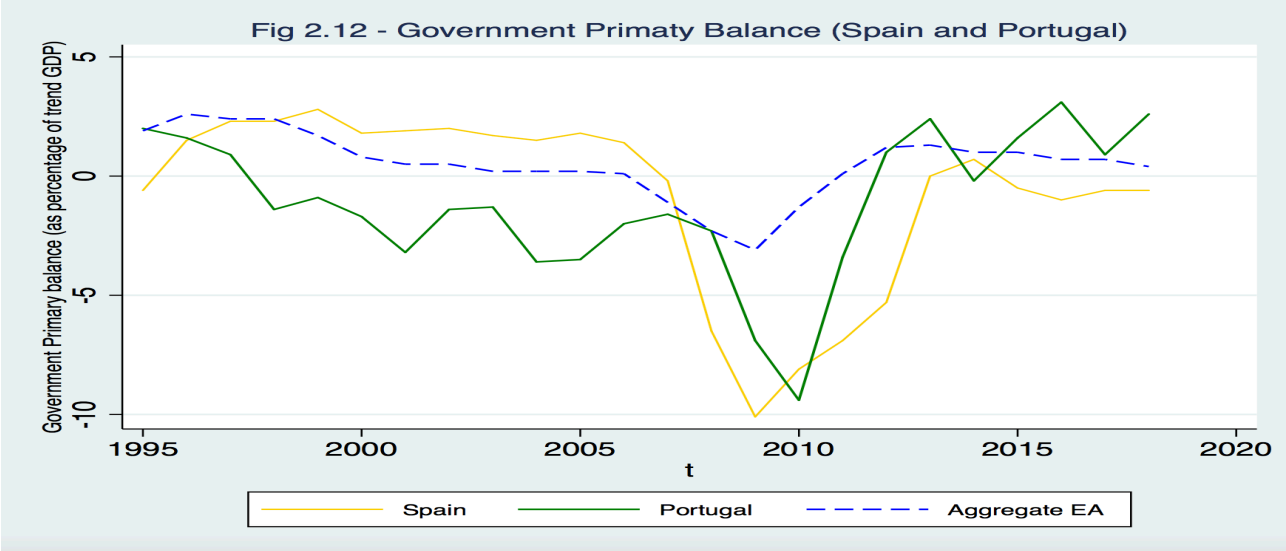
Also Spain and Portugal recorded an explosion of government debt after 2007. As it is possible to note in Figure 2.11 government debt almost tripled in Spain and almost doubled in Portugal[20].



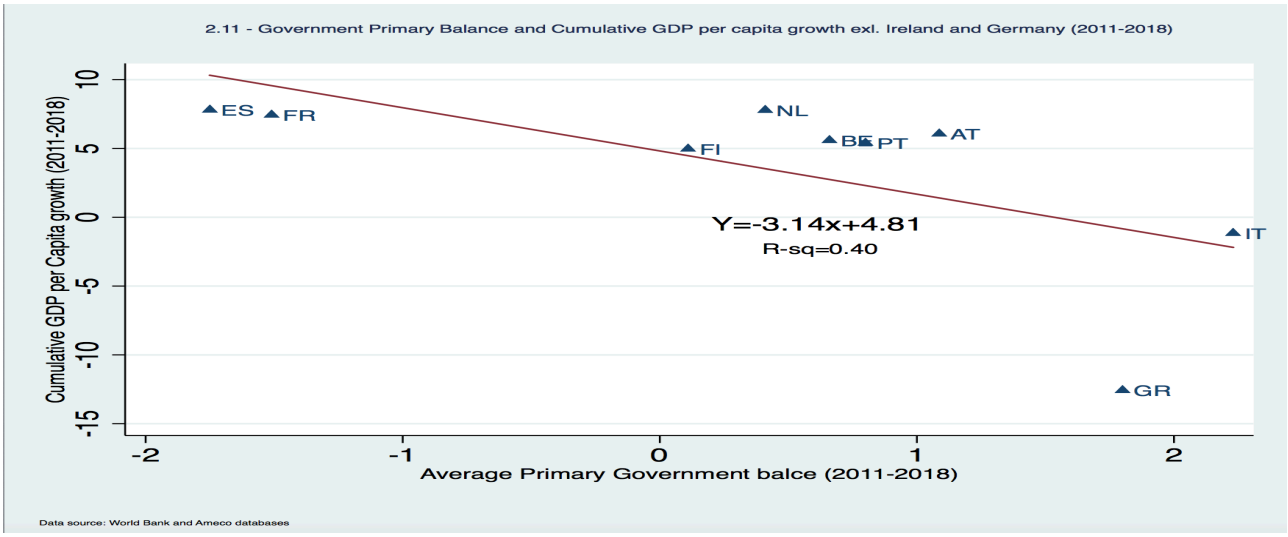
Contrary to Italy that was forced to implement austerity policies until abruptly bringing its primary surplus from 0.6% in 2011 to 3.2% in 2012 under financial market pressures, Spain and Portugal (whose government debts was much lower) were allowed to record negative primary government balances during the height of the crisis.

[20] In Appendix 1 I will provide an overview on the effects of government debt on economic growth both inside and outside the Economic and Monetary Union

Spain was also able to balance its primary government budget gradually until stabilizing it at values around zero in period 2013-2014 and below zero in the period 2015-2018 (as in the case of France).



The negative relationship between "austerity" or fiscal consolidation and cumulative economic growth in the countries of the Euro Area is shown in figure 2.13. The year 2011 is chosen as benchmark in order to insulate the years of the Global Financial crisis and focus only on the second stage of the double dip recession experienced by many European economies, the peripheral ones in particular. Furthermore in the period 2011-2012 the crisis of sovereign debt intensified Spain, Portugal, Greece, Ireland and Italy were forced to implement harsher austerity measures. Also De Grauwe and Ji (2013b) take the year 2011 as a reference year because it was actually the year during which the interest rates on peripheral countries government bonds peaked and the European and national authorities reacted with a "panic-driven austerity".



According to the OLS regression output estimated on the sample of countries visible in Figure 2.11, one percentage point increase in "austerity" or fiscal consolidation has been associated on average to a cumulative reduction of 3.14% in GDP growth in following 7 years[21]. As matter of facts, Italy and Greece, the countries have been required to implement the harsher austerity measures since 2011, were actually the countries that recorded the worst economic performances. Symmetrically France and Spain, the only two countries of the "old" EMU that have been allowed to record negative primary balances, have been actually amongst the best performers in terms of economic growth during the period 2011-2018.

2.6 The Estimated Model

The estimations reported in Chapter 1 for the period 1995-2018 suggest that absolute beta convergence between the early members of the Economic and Monetary Union is unrealistic because the economies are not converging towards the same steady state. When countries are not homogeneous in their initial fundamentals, convergence can be found only in "conditional terms", that is, by holding constant a set of conditioning variables (Sala-i-Martin, 1995; Barro and Sala-i-Martin, 1992).

In order to test convergence conditional on a primary government balance and a set of other variables I specify the following fixed effects regression model[22]:

$$(1/T)\ln(y_{it}/y_{it-T}) = \alpha_i + \beta_1 \ln(y_{i,t-T}) + \beta_2 (X_{1,it}) + [(\ln(y_{i,t-T}) \cdot (X_{1,it})]\,\beta_3 + \Psi Z_{i,t} + \Pi + \mu_{it}$$

i=1,2,3.....,n and t=1995-1997, 1998-2000,.....,2016-2018

(2.2)

Where $y_{i,t-T}$ denotes the per capita income in country *i* at the beginning time interval. T is the length of the time interval (T=3). Symbol α_i (i=1...n) is the unknown intercept for each country in the sample and X_2 denotes the variable of interest of this inferential analysis, namely the primary government balance as percentage of trend GDP. Trend GDP represents the potential output or the productive capacity of an economy insulated by its

[21] Ireland and Germany are not included in this cross section of countries because average growth observed in Ireland represents a statistical outlier while, according to Bernanke (2015), Germany experienced sustained economic growth with an export-led strategy that allowed the country to offset the negative effects of fiscal austerity. It is precisely for this fact that in the final model will be estimated on a longitudinal panel dataset that allows to capture short-term adjustments, the evolution of the relationships between variables over time and to remove the drawbacks of OLS regression inference on cross sectional data

[22] The model will be estimated on two samples of countries. The first sample called of "Old EMU" of EMU-12 contains Germany, the Netherlands, Belgium, France, Finland, Austria, Ireland, Spain, Italy, Portugal and Greece. The second sample called "Old EU" or EU-15 contains all the countries included in the first sample (Old EMU) plus Denmark, Sweden and the United Kingdom

cyclical component, therefore choosing the "primary balance as percentage of trend GDP" is a strategy to reduce the potential endogeneity of the variable.

$Z_{i,t}$ denotes is a vector of control variables that hold constant the steady state, commonly utilized in the theoretical and empirical literature on economic growth and convergence: investment rate as share of GDP, human capital proxied as the share labour force with tertiary education and population growth. Symbols Π denotes a dummy variable that indicates the sovereign debt crisis in the period 2011-2013 in the four Southern European countries plus Ireland. Symbol μ denotes the error term.

The polynomial $[(\ln (y_{i,\, t-T}) \cdot (X_{1,\, it})]$ denotes an interaction term between government primary balance as percentage of GDP and the natural logarithm of GDP per capita at the beginning of each time interval.

The use of interaction terms in convergence studies is an econometric modelling technique especially common in the literature on the linkages between globalization, financial development and income convergence (Gomes Neto and Veiga, 2019; Abiad et al, 2007; Aghion et al, 2004).

In this case with this technique it is possible to estimate whether austerity measures in the pursuit of fiscal consolidation over the period 1995-2018 have a symmetrical negative effect on economic growth across the countries or it especially affects economic growth in the poorer economies, thus undermining convergence within the Economic and Monetary Union.

Indeed the equation can be algebraically rearranged as follows:

$$(1/T) \ln (y_{it} / y_{it-T}) = \alpha_i + [\beta_1 + (\beta_3 x_{2,it})] * \ln (y_{i,\, t-T}) + \beta_2 (X_{2,\, it}) + \Psi Z_{i,t} + \Pi + \mu_{it} \quad (2.3)$$

If coefficient estimate for GDP per capita at the beginning of each time interval (β_1) is negative and statistically significant (implying "beta" convergence) and coefficient estimate for primary government balance (β_2) is negative and statistically significant (indicating generalized negative effects of fiscal consolidation on growth), a positive and statistically significant coefficient estimate for the interaction term (β_3) would mean that fiscal consolidation or austerity (X_2) reduces the "negativity" of β_1 coefficient, thus the speed of convergence. This essentially means that fiscal consolidation or austerity affects economic growth more in the poorer economies that according to the theory are supposed to grow more rapidly than the richer ones. As the Neoclassical Theory predicts, coefficient estimates for Investment rate to GDP and percentage of labour force with tertiary education are expected to take on positive signs while coefficient estimate for population growth is expected to take on negative sign.

The output of the model estimated on the two samples of countries ("Old EMU" and "Old EU") is reported in Table 2.2.

Table 2.2 Dependent Variable: GDP per Capita growth	Sample "Old EMU" or EMU-12 (a) Number of Obs=88 Number of Groups=11 Within R-sq= 0.67	Sample "Old EU" or UE-15 (b) Number of Obs=112 Number of Groups=14 Within R-sq= .62
Log of GDP per Capita (t-T)	-9.72 *** [2.78]	-10.28*** [3.45]
Government Primary Balance to GDP	-6.43*** [2.3]	-4.81** [2.36]
Log of GDP per Capita (t-T) * Government Primary Balance to GDP	.64*** [.23]	.48** [.20]
Investment rate to GDP	.44*** [.11]	.39*** [.10]
Labour force with Tertiary Education	.12*** [.05]	0.13*** [.04]
Population growth	-1.52*** [.45]	-1.03* [.52]
Sovereign Debt crisis (ψ)	-2.7*** [.83]	-3.47*** [.83]
Constant	93.12]*** [27.3]	152.74*** [43.]
*** Significant at 1% **Significant at 5% *Significant at 10% Standard Errors in brackets [ ]		
	Hausman Test: chi2 = 20.93 Prob>chi2 = 0.003	Hausman Test: chi2 = 40.00 Prob>chi2 = 0.0000

2.7 Considerations on Panel Data analysis with Fixed Effects or "Within Group Estimator"

Hsiao (2006 and 2005) underlines two main advantages provided by the utilization of panel data with respect to cross sectional or time series data estimations.

Firstly, panel data estimations have greater capacity for capturing the complexity of social behaviour than a single cross-section or time series data (Hisiao, 2003).

Secondly, panel data estimation provides more accurate inference of model parameters. Panel data usually contain more degrees of freedom and can also help to relax any eventual presence of multicollinearity between the predictors than cross-sectional analysis (Hsiao, Mountain and Ho-Illman, 1995).

Panel data combines time series (with N=1 and t= 1, 2,.....*T*) and cross section (with n=1,2,....*N* and T=1) and allows the analysis of whether a causal relationship from the predictors to the dependent variable is maintained over time.

Furthermore 3 years time intervals permit to "insulate" the period of the global financial crisis (2007-2009) and the period of the sovereign debt crisis (2010-2012). The time interval of three years is also chosen because of the limitation of the availability of data for the variable primary balance to GDP that represents the object of the hypothesis of this chapter. Indeed data for government primary balance are available in AMECO database from 1995 and in order to obtain a suitable number of observations (and capture the changes over time) the choice of this choice seems the most appropriate. On the one hand using 4 or 5 years non-overlapping averages would mean to work on too few observation. On the other hand, working on 2 years non-overlapping average would not allow fully capture the changes in GDP growth when regressed on the log GDP per capita at the beginning of each time interval.

Besides the choice of the time intervals for observation, a common issue that arises when working on panel data concerns the choice between fixed effects with OLS Estimator or random effects with Generalized Least Squares Estimator (GLS).

As regards the GLS estimator, individual effects of each entity *i* are assumed to be uncorrelated with the exogenous variables included in the model. However, these estimators relying on such assumption are not suitable because it is precisely the fact of correlation that forms the basis in favour of panel data approach excluding cross-section (Islam, 1995:1138).

Fixed effects estimator allows to address the problem of correlation between the unobserved variables and the regressors by treating each country's intercept as an unknown intercept to be estimated as one for each country *i* in the panel in order to control for heterogeneity (Stock and Watson, 2014). Furthermore, sampling units in the panel are almost all the countries belonging to an integrated economic area and with specific characteristics (geographical location, cultural heritages and structures of society), therefore "countries" cannot be treated as randomly selected individuals as in the case of the inferential analyses conducted for example on the determinants of citizens' wage in different districts of large cities.

From the technical point of view, also the output of the Hausman Tests applied to the model estimated for the two samples suggests the suitability of Fixed Effects estimator to infer the data.

However, estimations on panel data with fixed effects tend to produce much larger coefficient estimates for the log of initial GDP per capita than OLS estimations on cross-section. According to Barro and Sala-i-Martin

(2005:495), fixed effects estimations of speeds of convergence ranging from 12 to 20% per year are not uncommon in the literature. Indeed, one concern with fixed effects arises from the need to include many time series observations in the panel and this procedure can be carried out only by shortening the time periods within which the growth rate is computed. In other words, the dependent variable tends to be growth rates over two to five years and growth rates tend to capture short-term adjustments around the trend rather than long-term convergence.

However, it is worth to remind that this convergence is "conditional" in the sense that countries with lower GDP per capita converge faster towards their own steady state equilibrium and not towards a common steady state.

2.8 Discussion of the Results

The estimation of the model yields to very interesting results. First of all the results are in compliance with the Neoclassical Growth Model and the traditional conditional convergence studies developed in the empirical literature by Barro (1991), Barro and Sala-i-Martin (1991) and Makiw et al (1992). In fact both physical capital accumulation, denoted by the variable investment rate to GDP, and human capital accumulation, denoted by the educational attainment of the labour force, exert a statistically significant effect on the steady-state economic growth. Furthermore, as predicted in the Solow Model (1956), population growth negatively affects growth in income per capita in the sample of European countries under analysis.

As expected the dummy variable, which takes on value 1 if a country experienced a sovereign debt crisis (Italy, Spain, Greece, Portugal and Ireland) in the time interval 2010-12, bears a negative and statistically significant coefficient estimate. The inclusion of the mentioned dummy variable in the model has a twofold utility. First, it allows differentiate between countries that experienced troubles in the sovereign bonds market and countries that did not experience this problem. Furthermore a "sovereign debt crisis" commonly arises in advanced economies when they are part of a monetary union (De Grauwe, 2011). Therefore the inclusion of this dummy variable, on the one hand, represents a strategy to take into account the fact that peripheral countries plus Ireland experienced a sovereign debt crisis that further exacerbated the economic downturn because of the fact that they are members of a monetary union. On the other hand, the inclusion of the dummy variable for the countries that experienced a sovereign debt crisis in the time interval 2010-2012 represents a reasonable econometric strategy to control for the fact that income per capita dropt more steeply in those countries, thus further reducing the potential endogeneity of the variable "primary government balance as percentage of trend GDP".

Finally, coming to the main variable of interest of this analysis, that is "primary government balance as percentage of trend GDP", the results of the model are remarkably interesting. First, the effect on one percentage point change of fiscal consolidation on economic growth is much stronger in absolute terms than the effect of a change in any other variable included in the model, such as investment rate and human capital.

Second, the positive and statistically significant coefficient estimate on the interaction term, confirms that fiscal consolidation during the period 1995-2018 has produced asymmetric effects on economic growth across the countries of the EMU, penalizing growth in particular in the "poorer" economies what are supposed to catch-up with the richer ones.

2.9 Conclusions

The empirical results of this analysis are very interesting and informative both from the academic point of view and for policy-makers because the results shed a light on the relationship between growth and contractionary budgetary policy in the EMU. First of all I show that after the outbreak of the global financial crisis, the fiscal adjustment programs implemented in may countries of the EMU countries had a pro-cyclical effect. This findings confirm the results of the analysis of Ostry at al (2015) according to which the costs of the tax increases or expenditure cuts required to bring down the debt may be much larger than the reduced crisis risk engendered by the lower debt.

The empirical evidence in particular suggests that the countries that have actually been forced to implement the harsher austerity measures were actually the ones that recorded the worst economic performances during the crisis under the speculative pressures of financial markets as in the case of Italy or under the conditionality of financial assistance from international creditors as in the case of Greece.

Italy that on average recorded a rate of growth below the Greek levels during the period 1995-2018 was also the sole peripheral country that recorded persistent primary budget surpluses for fiscal consolidation since the mid of the 1990s.

After these preliminary findings I have estimated a model to assess the effects of "permanent" fiscal consolidation on economic growth and conditional convergence during the period 1995-2018, based on a longitudinal panel dataset. According to the results, fiscal consolidation impacts economic growth much more than any other variable. Indeed a percentage point increase in primary government balance for fiscal consolidation is expected to reduce economic growth by 6.43% in the time interval (Table 3.2a). The negative impact of one percentage point increase in fiscal consolidation is much stronger than the positive impact of one

percentage point increase in investment rate to GDP or an in the level of human capital (proxied as percentage of labour force with tertiary education).

The most relevant finding of this analysis is the positive sign and the statistically significance of the coefficient estimate for the interaction term [ln ($y_{i, t-T}$) · ($X_{1, it}$)] that confirms that fiscal consolidation and austerity do not affect homogeneously economic growth in the economies of the EMU. Rather, the monotonic European fiscal rules affect primarily the countries with lower income per capita that are supposed to catch up with the richer ones. From a technical point of view, the positive and statistically significant coefficient estimate on the interaction term means that the European fiscal rules reduces the steady state growth in the peripheral countries which could consequently never reduce the gap in income per capita with the richer economies of the EMU-12 or the EU-15.

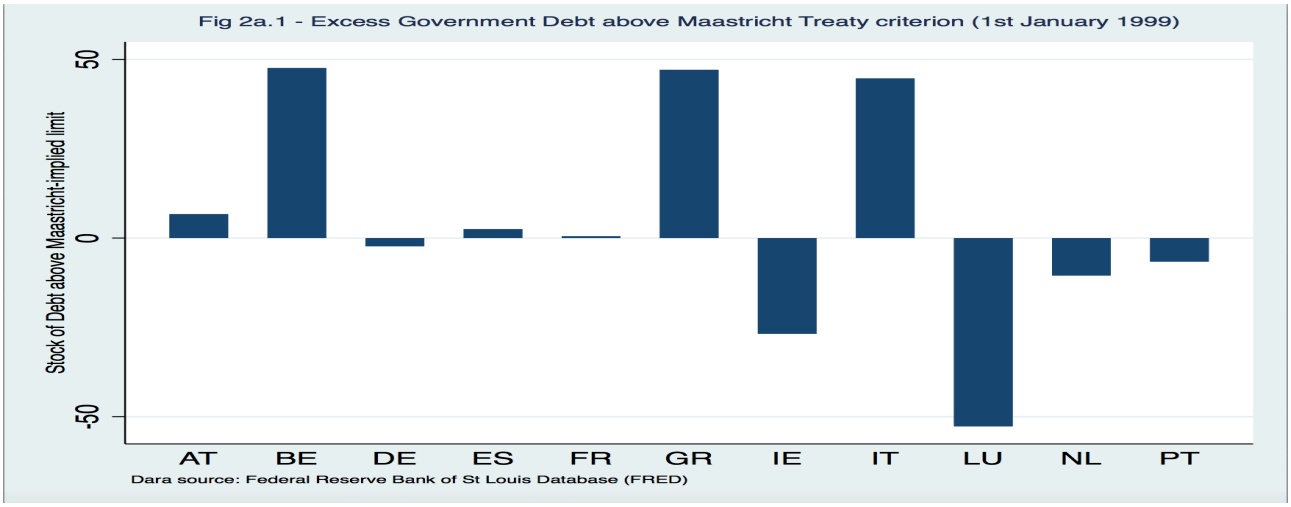
In this framework it is possible to conclude that the compliance of monotonic European budget rules, regardless of the conditions of the economy, is one of the most relevant determinants of the divergence observed within the EMU-12 and the EMU-15 groups since the mid of the 1990s.

Appendix 2.1: General Government Debt and Economic Growth inside and outside the EMU

The relationship between government debt and economic growth is a topic that has been common concern in the literature in particular since the breakout of the Global Financial Crisis that was associated to sharp rises in the stock of government debts (Igan et al, 2019). This topic is particularly sensitive in the Euro Area because of the absence of a federal budget and a common insurance scheme on bank deposits that makes the financial health of banks and sovereigns intertwined (Dell'Ariccia er al, 2018; Jarociński and Maćkowiak, 2017; Stiglitz, 2017; Zingales, 2014). Given this nexus between sovereigns and banking system the Maastricht Treaty initially established strict public finances conditions in order to qualify for the accession on the 1st January 1999.

However some countries were allowed to join the Economic and Monetary Union in 1999 without fulfilling the Treaty's condition that imposed a debt to GDP ratio equal to 60%.

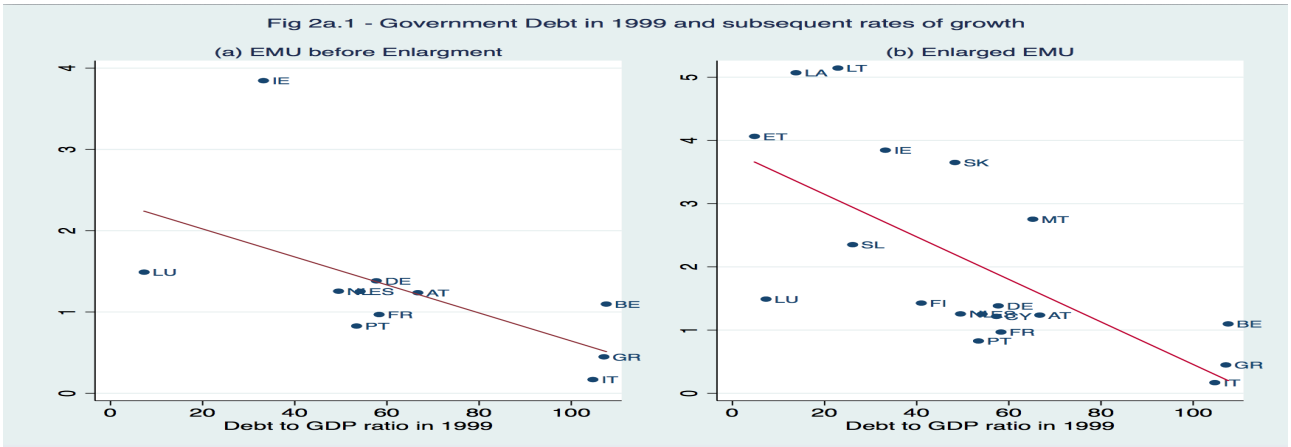
Figure 2a.1 shows the difference between the Treaty-implied ratio and the actual government debt to GDP ratio of the countries that joined the European Monetary Union in 1999 and 2001 as in the case of Greece[23].



May the magnitude of initial government debt in 1999 have negatively affected subsequent economic performances of the countries that joined the Economic and Monetary Union?

In order to answer the question, I provide the plot with the fitted line of the magnitude of government debt in 1999 and average economic growth during the period 1999-2018 (Figure 2a.2) and as it is possible to note high government debt in 1999 been negatively associate with average economic growth in the following 20 years.

23



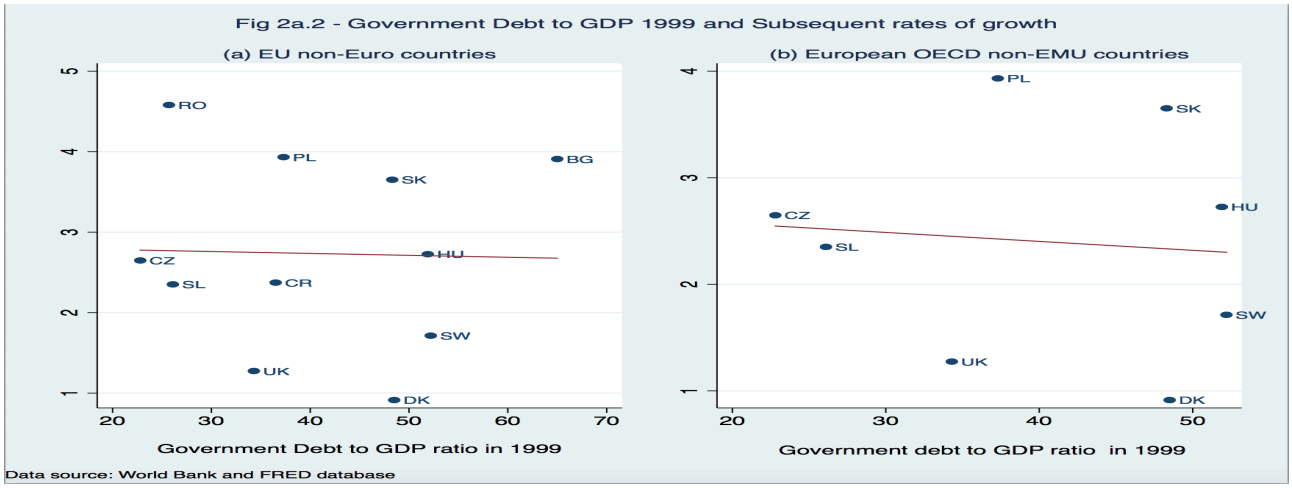
The graphs show that the countries with the worst economic performances since the creation of the Economic and Monetary Union were actually Greece and Italy that were actually the countries that joined the club with the highest government debt to GDP ratios. At the same time the best performing economies since the introduction of the European single currency were Luxembourg and Ireland that actually joined the club with government debt to GDP ratios below 40%. In Table 2a.1 I report the output of the regression of growth during the period 1999-2018 on initial GDP per Capita and the government debt ratio on the 1st January 1999.

Tab. 2a.1	EMU before the Enlargement	Enlarged EMU
Log of GDP in 1999	-1.19 [1.0]	-1.29*** [.37]
Government debt to GDP in 1999	-.03** [.009]	-.025*** [.002]
R^2	.53	.76
Pairwise correlation	-.66	-.75
***Statistically significant at 1% **Statistically significant at 5%		

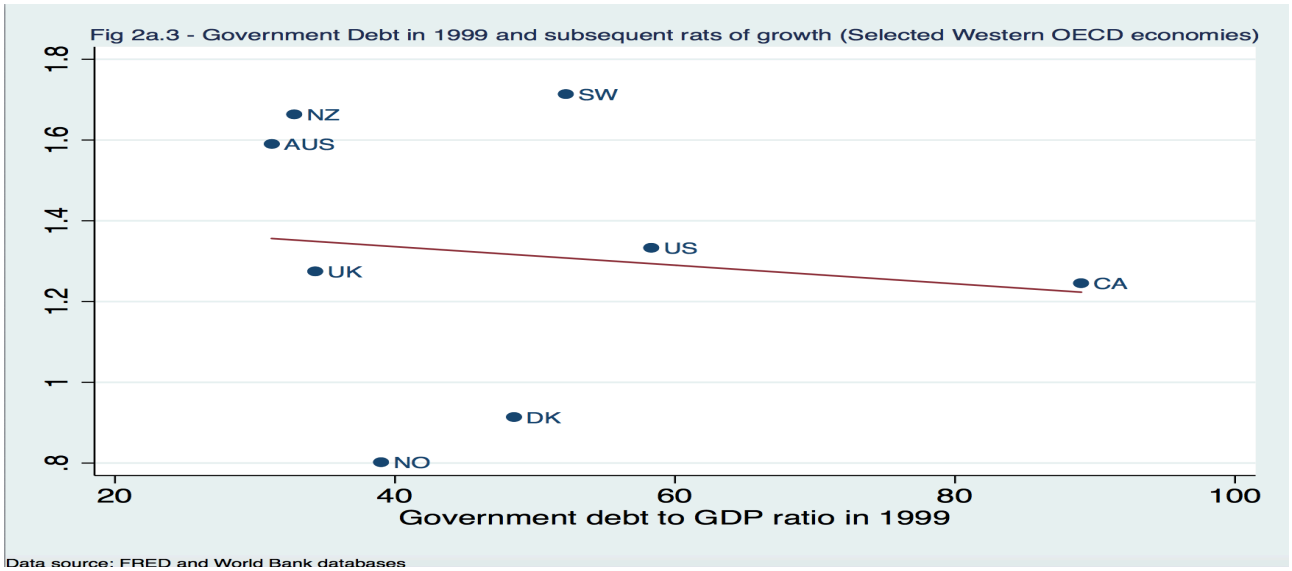
As it possible to note the regression output confirms that the variable "government debt ratio in 1999" has a negative impact on growth and that convergence in the Economic and Monetary Union during the period 1999-2018 is detected only if NMS that joined the EMU are included in the sample.

After having empirically estimate the negative relationship between government debt and economic growth, there is a second question to be answered to assess how the EMU membership has affected the peripheral countries of the monetary union. Does government debt negatively affect economic growth regardless of the monetary system or does government debt negatively affect economic growth in advanced economies only when they join a monetary union as asserted by De Grauwe and Ji (2015), De Grauwe (2011) and Krugman (2011)?

Figure 2a.2 shows the absence of a strict negative relationship between government debt in 1999 and subsequent economic performances in the European Union non-Euro countries (a) and within the group of European non-EMU countries member of the OECD.



The negative and statistically significant relationship between the two variables is also absent also within the sample selected Western high-income OECD countries.



Indeed government debt is positively related to higher interest rates and higher government interest rates expenditures. Given the budget constrains imposed by the EMU membership, in this framework countries are forced to increase their primary balance surpluses in order to comply with rules established by the treaties and reassure financial markets about public debt sustainability. As remarked by Krugman (2011) and De Grauwe

(2011), the absence of lender of last resort in the member countries of the EMU forces the weaker countries to offer higher interest rates in order to overcome investors' reluctance to purchase riskier governemnt securities. In the Appendix 3.1 of Chapter 3 I will provide a graphical example of the disadvantage of the constrain entailed by the membership of a monetary union during the periods of financial troubles.

Chapter 3

General Government Fiscal policy and regional divergence in the EMU since the outbreak of the Global Financial Crisis. Evidence from a Multilevel Mixed Effect Model

3.1 Introduction

In Chapter 2 I have analysed the negative impact of restrictive fiscal policy on growth and convergence within the EMU-12 and EU-15. By allowing the three-year averaged variable "government primary balance" to interact with the natural logarithm of GDP per capita at the beginning of each time interval I showed that restrictive fiscal policy affects in particular the "poorer" countries that, according to the theory, would be supposed to catch up with the richer ones.

In this chapter I will test the hypothesis that the "bifurcation" in regional economic growth observed in Europe since the early 2000s is, among others, the consequence of contractionary fiscal policy implemented by governments as policy response to the spread of the Global Financial Crisis.

The model will be estimated with Multilevel Mixed Effects regression technique on a panel dataset built on 3-year non-overlapping averages during the period 2007-2015, thus obtaining observations over three time intervals (2007-2009; 2010-2012; 2013-2015) for each of the 156 regions in the sample clustered into 10 groups.

The relevance of the analysis I conduct in this chapter lies on its originality. Indeed, despite empirical analyses on the effects of contractionary fiscal policy on economic growth have been flourishing since the Global Financial Crisis, no authors have directly estimated the effects of government fiscal consolidation in time of crisis on regional economic performances in Europe. Rather authors have extensively analysed the effects of fiscal consolidation on economic growth in Europe at country level (Heimberger, 2016; Cugnasca and Rother, 2015)

However, when it comes to the analysis regional growth and convergence many studies limit themselves to test absolute beta-convergence during the period that comprises the Global Financial Crisis and the sovereign debt crisis to show that regional convergence in the EU-28 has bifurcated and shifted from Southern Europe to Central and Eastern Europe (Gross, 2018; Alcidi, et al, 2018).

Other studies incorporate spatial dependence in the form of inverse distance matrices in the well-known regression equation of conditional beta convergence as an attempt to incorporate geographical spillovers in the process of regional growth and convergence (Özyurt and Dees 2015; Harris, 2008).

The relevance of this analysis is also confirmed by the output of the model. On the one hand, I quantify the effects of central government fiscal policy on within-country regional performances and I empirically show that contractionary fiscal policy measures are the principal determinant of weak or negative regional performances observed in many countries during the period 2008-2015.

On the other hand, I show that almost 60% of total cross regional variance in economic growth may be attributed to between-countries differences in macroeconomic fundamentals, among which government fiscal policy. Furthermore the disaggregated slopes of the predictor general government primary balance as percentage of trend GDP show that negative "Keynesian effects" of fiscal consolidation are much stronger in the peripheral countries and France than in the "core" countries. Thus, the empirical evidence about the negative impact of fiscal consolidation on convergence at country level showed in Chapter 2 is also confirmed at regional level.

3.2 Description of the Data

The main source of data used for the dataset is the European Regional Database made available upon license by Cambridge Econometrics Ltd in 2017. This is the unique database that provides disaggregate sectorial data for regional economic activity for all the NUTS-1, NUTS-2 and NUTS-3 European territories. Data are available until the year 2015 therefore I cannot extend the analysis of the effects of fiscal consolidation on (regional) economic growth to the year 2018 as in Chapter 2.

Cambridge Econometrics database contains data for employment, population, aggregate GDP, aggregate GVA, and aggregate investment rate. Data for GDP and GVA and Investment rates are expressed in Euro at 2005 constant prices. The database also provides disaggregated data for regional economic activity of the different sectors of the economy.

Therefore the data for GDP per Capita, GDP per capita growth, population growth and sectorial investment rates utilized in the model are sourced from this database.

The regional data for labour force educational attainment rate are collected free in the free access regional database made available by Eurostat.

Finally, data for general government balance as percentage of trend GDP are sourced from AMECO database.

The annual observations from 2008 to 2015 are averaged over 3-year non-overlapping intervals and three time-observations for each of the sapling unit is obtained. The dataset is built on 156 regional sampling units and includes 13 NUTS-1 territories (Belgium: Brussels; Germany: Brandenburg, Bremen, Hamburg, Mecklenburg-Vorpommern, Saarland, Sachsen-Anhalt, Schleswig-Holstein and Turingen; Spain: Community of Madrid; France: Ile-de-France and Nord-pas-de-Calais; Greece: Attika) and 143 NUTS-2 territories. The 156 NUTS territories are clustered in 11 groups (countries) belonging to EMU-12[24].

[24] Luxemburg is not included in the sample because it is classified as a NUTS0 territory without any other subnational territorial levels. The two Irish regions are not included in the sample because of their uncommon rates of growth recorded during the period 2013-2015.

NUTS-1 territories are the territorial units where the administrative territory of a metropolitan area corresponds to a region as a whole (as in the case of Ile-de-France and the metropolitan area of Paris). As a consequence Sub-Regional (NUTS-2 and NUTS-3) data for territorial units (i.e. NUTS-2) clustered within NUTS-1 territories are not available in the database.

3.4 Methodology

Multilevel regression models are specifically designed for the analysis of the relationship between data that have a clustered structure. Such data arise routinely in various fields, for instance in medical research with patients nested within hospitals or in educational research with pupils nested within schools (Hox, 1998).

Hierarchically clustered data may arise also in economic research for example when analysing cities that are clustered into regions or regions that are clustered into countries, and this data structure requires a specific estimation technique. The inverse and basic intuitive idea is that when drawing a random sample and there is no clustering, than OLS and other linear techniques make more sense.

Indeed, when data are clustered in higher-level units or groups (i.e. regions-country, municipalities-regions), *within-group* observations tend to be more similar to each other than they are *across groups* because they are influenced by group membership. Furthermore in the case regional analysis, excluding the state level units would mean not being able to take into account potentially relevant higher-level determinants of regional economic growth such as central government economic or regulatory policy (i.e. monetary policy, fiscal policy, labour market regulation).

As in standard regression analyses, the purpose of multilevel modelling is to model the relationship between a response variable and a set of explanatory variables. The difference is that multilevel modelling involves units of observations at different "levels" (Rabe-Hesket and Skrondal, 2012).

Given the fact that I want to study the response of regional growth (defined as Level-2 variable) to central government fiscal policy (defined as Level-1 variable), I build a Multilevel Random Intercept and Slope Model. Therefore the *within-group* relationship between regional economic growth and government fiscal policy will be modelled by allowing each group's fitted line to have different slope, meaning that the relationship between regional economic growth and government fiscal policy is different in each country.

Also in Chapter 2, by including an interaction term within the conditional convergence regression model estimated with fixed effects, I have showed that contractionary government fiscal policy has asymmetric effects on economic growth because it affects more the "poorer" countries than the richer ones.

Therefore with this econometric strategy I will be able to estimate the Fixed Effects slope for the whole group of 156 regions and the random effects slope for each group regions nested within a country in order to show which are the regions that were more penalized by austerity measures.

3.5 Stylized Facts and Descriptive Statistics

As mentioned in the second chapter of the thesis, since beginning of the process of monetary integration in Europe, policy-makers have chosen fiscal consolidation as the main criteria for the access and the permanence of a country in the Economic and Monetary Union.

Fiscal consolidation has been chosen also as the strategy to bring the economy back on the track of growth since the outbreak of the Global Financial Crisis following the hypothesis of "expansionary austerity".

However I showed that fiscal consolidation contributed to undermine the process of convergence within the EMU because it affected more the peripheral economies than the core ones.

Besides the hypothesis of "expansionary austerity", countries were "de facto" forced to consolidate their government balances in times as a consequence of the fact that they are member of a monetary union.

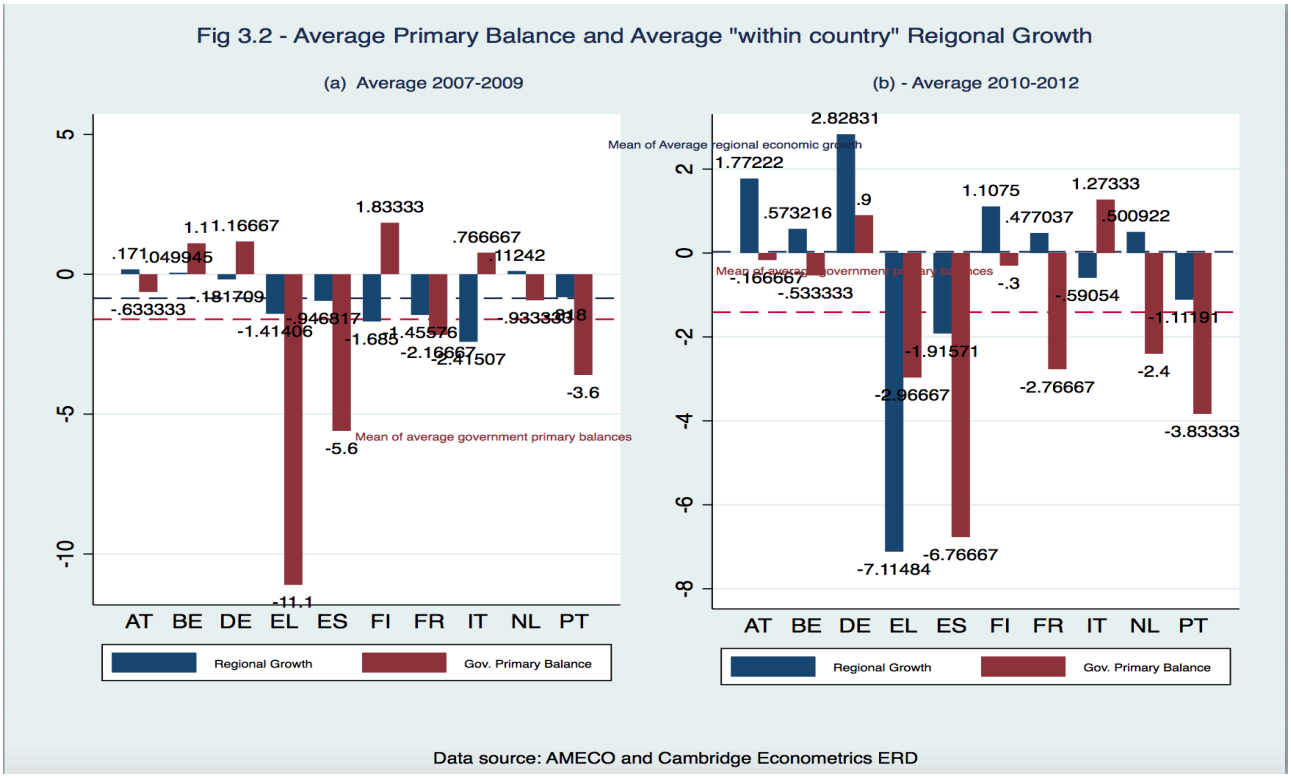
As De Grauwe and Ji (2014) remark, the nature of fiscal policies was dramatically changed by the creation of the Euro whose effects were largely overlooked by it designers. On the one hand, the structural change made the countries vulnerable to self-fulfilling liquidity crises that could push these governments into insolvency. Thus, financial markets acquired great power over the governments in that they could force them into default.

On the other hand the consequence of the loss of monetary sovereignty has been that these governments were forced to switch off the automatic stabilizers in the budget when pressured by financial markets during financial crisis and economic slowdowns. In this framework, after the outbreak of the Global Financial Crisis, weaker countries of the EMU experienced a remarkable increase in interest rates expenditures that forced them into austerity programs[25]. As already mentioned in the second chapter fiscal consolidation after 2010 was the cause of the "double dip" experience by many economies of the EMI during the period 2010-2012. General Government fiscal austerity of course produced effects also on regional performances within the countries that implemented austerity programs in order to consolidate their balances after the Global Financial Crisis that led to a remarkable increase of government debts across the Western economies during the period 2007-2009.

However, as in the case of countries, austerity produces different outcomes on economic growth also across the regions.

[25] In Appendix 3.1 I will provide a brief comparison of the cases of government debt in Spain and the United Kingdom. In Appendix 3.2 I will provide a brief comparison of the cases of fiscal consolidation in the EMU as a whole and the United Kingdom

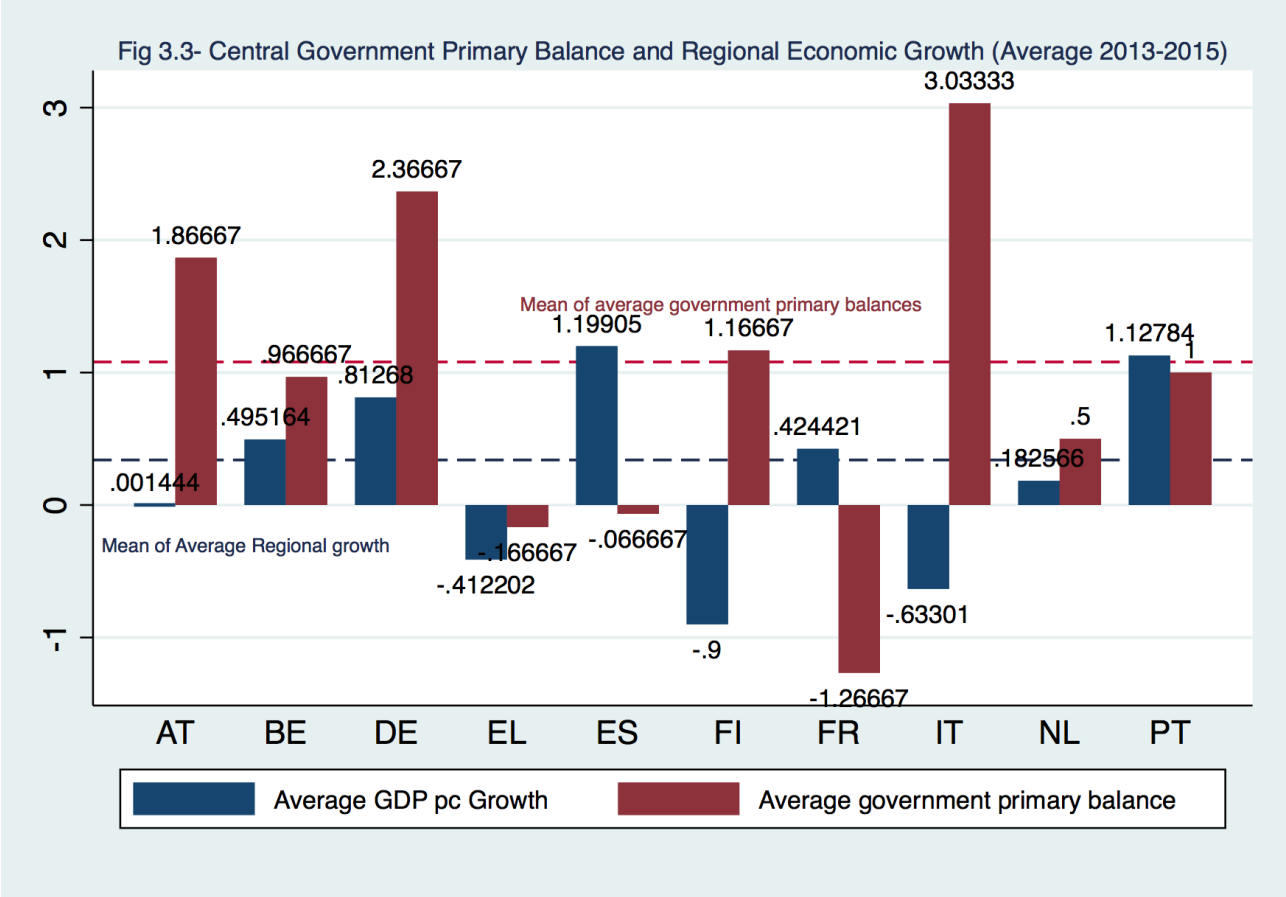
Figure 3.2 shows the bar chart of average primary balance and within country regional growth during the time intervals 2007-2009 and 2010-2012[26].



As it is possible to note, during the Global Financial crisis (a) and the period of the second recession that encompasses the sovereign debt crisis (b) the relationship between government primary balance and "*within country*" regional growth does not appear symmetric across countries, suggesting that fiscal policy exerted different effects on regional performances within he countries.

However, if only period of economic recovery (2013-2015) is taken into account, it is possible to draw some preliminary considerations before the estimation of the model.

[26] Note that here "within country" regional growth is the unweighted average of regional rates economic growth observed in each time interval. Given the fact that the regions are not weighted for their share of total GDP, this indicator does not correspond to the rate of growth observed in the country within which the regions are nested. Therefore in figure 3.2a, Italian "within country" regional growth equal to -2.41 does not match the growth performance of the country. For example Region Lombardia represents more that 20% of the Italian GDP and a drop in GDP in that regions would produce different effects on country economic performance with respect to a drop in GDP in smaller region. However .I use this variable because I am interested in regional economic performances within the countries and not in country performances

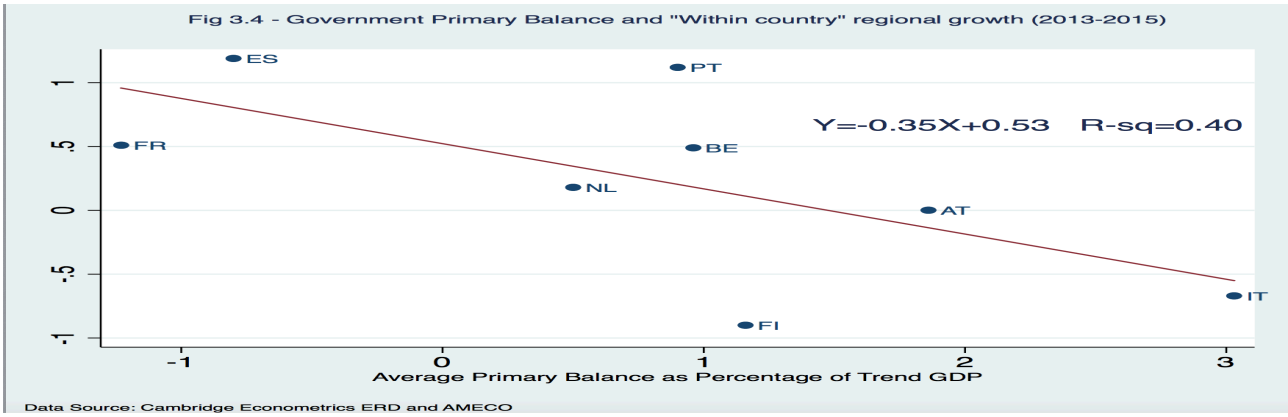


As it is possible to note, during the period of "European" recovery Italy that recorded the large government primary surplus (+3%) was also the country that recorded one worst "*within country*" regional economic performances (-0.63). The worst "*within country*" regional economic performance was observed in Finland whose central government recorded a primary surplus equal to 1.16%.

At the same time, the best "within country" regional growth was observed in Spain that during the time interval recorded a slightly negative primary government balance.

In Figure 3.4 I provide the graph of the relationship between primary balance and "*within country*" regional growth during the period 2013-2015. Ireland, Germany and Greece are not included in the sample for the reasons I have already explained about outliers as exceptional rate of growth (Ireland[27]), economic growth pursued with an export-led strategy in time of fiscal consolidation (Germany) and the relevance and duration of the economic (Greece).

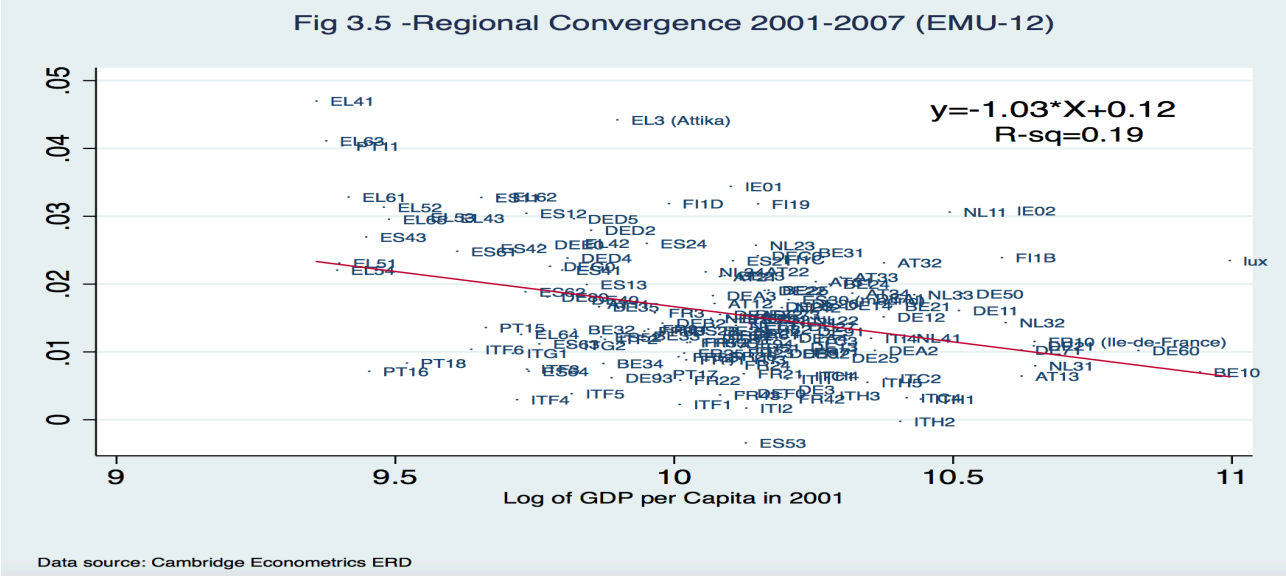
[27] During the time interval 2013-2015 the Irish region of Dublin "Southern and Eastern" grew at an average of 11% per year



As it is possible to note, in the sample of country there is an evident negative relationship between central government primary surpluses and within country regional rate of growth.

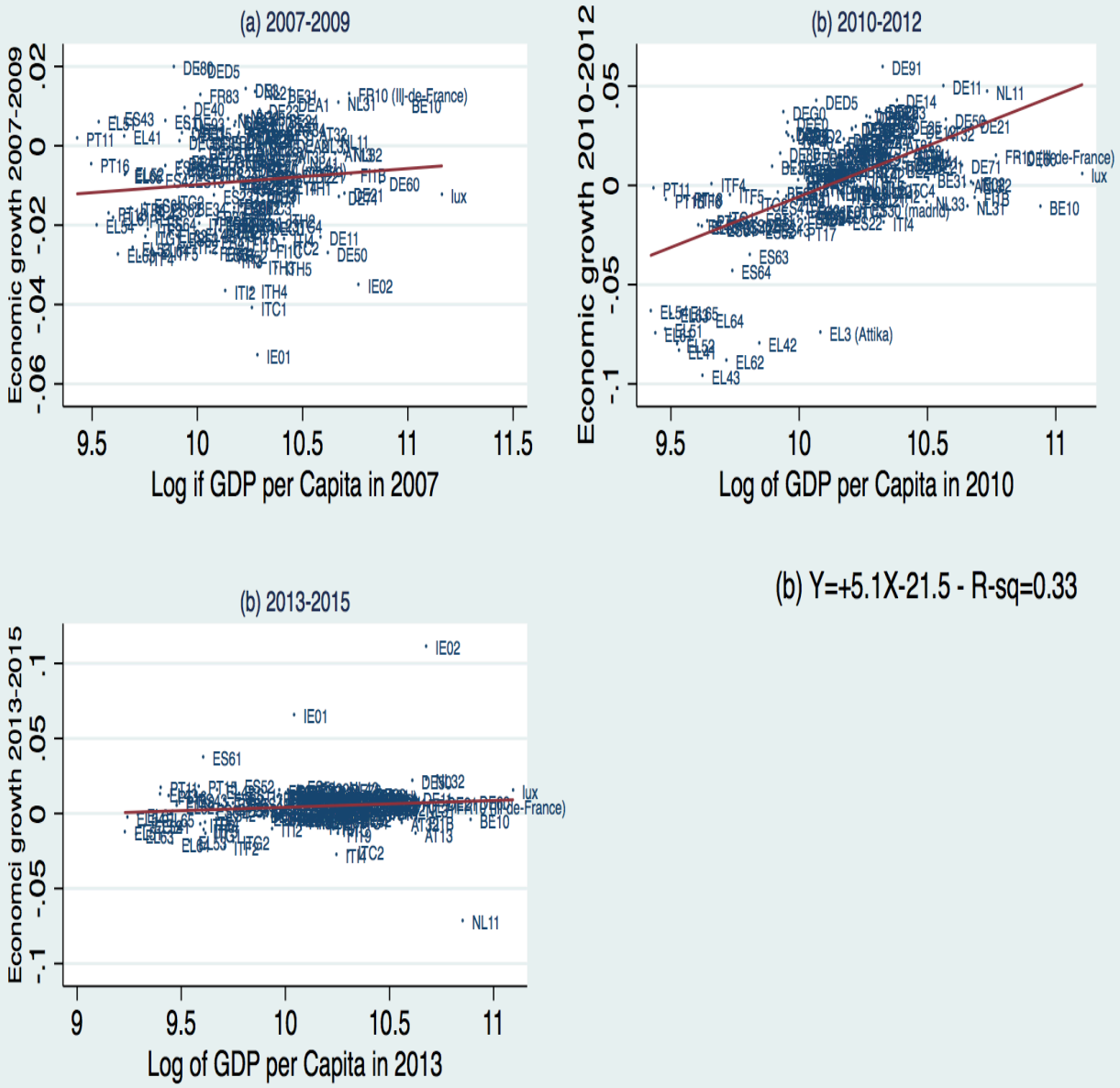
This negative relationship between the two variables is matched by an observable process of evident divergence between regions in terms of GDP per capita.

As Figure 3.5 shows, during the period 2001-2007 before the outbreak of the global financial crisis an overall process of regional convergence, despite not very pronounced, was observable in EMU-12.



However, since the Global Financial Crisis outbreak and the implementation of austerity programs aimed at fiscal consolidation, a process of regional divergence has been observable in all the phases of the crisis (2007-2009 and 2010-2012) and during the phase of recovery (2012-2015).

Fig 3.6 - Regional Convergence/divergence during the crisis (EMU-12)



Data Source: Cambridge Econometrics ERD

As it is possible to note the regions of the EMU have been diverging over the three time intervals under analysis. However, the peak of regional divergence was observed during the period 2010-2012 when the harshest austerity measures were implemented by governments in the peripheral countries. During that period it has been possible to even observe a statistically significant tendency of richer regions to growth faster than the poorer ones and diverged at a rate of 5% per year.

The divergence process seems to have faded during the time interval 2013-2015 when expansionary monetary policy of the ECB bought down interest rates on government bonds allowing the countries to loosening the grip of fiscal austerity.

3.6 The specification of the model

Mixed-effects models are characterized as containing both fixed effects and random effects. The fixed effects are analogous to standard regression coefficients and are estimated directly. The random effects are not directly estimated (although they may be obtained postestimation) but are summarized according to their estimated variances and covariances. Random effects can take the form of either random intercepts or random slopes (StataCorp., 2017).

Therefore with this particular econometric estimation it is possible to obtain the fixed effects slope for the whole sample of regions and the random slope of each group of regions nested within the countries (Hamilton, 2005).

The model is specified as follows

$$\text{Level 1: } Y_{ij,t} = \beta_{0j} + \beta_{1j}\,(X_{1j,t}) + e_{ij} \tag{3.1}$$

Where j denotes the subscript for groups (Level 2) and i is the subscript for individual sampling units. In this case regions (Level 1) *i* nested into country *j*.

Regression coefficients β_j*'s* vary across groups and this variation is predicted by a Level 2 explanatory variable Z. Therefore,

$$\text{Level 2: } \beta_{0j} = \gamma_{0,0} + \gamma_{0,1}\, Z_j + \mu_{0j} \tag{3.2}$$

$$\text{Level 2: } \beta_{1j} = \gamma_{1,0} + \gamma_{1,1}\, Z_j + \mu_{1j} \tag{3.3}$$

Where γ_{00} and γ_{01} are the random intercept and the random slope to predict β_0 from Z, and μ_0 is the error term.

At the same time $\gamma_{1,0}$ and $\gamma_{1,1}$ are the intercept and the slope to predict β_1 while μ_{1j} is the error term of the regression.

Replacing (2) and (3) in (1) and rearranging it is possible to obtain the multilevel mixed effects model as

$$Y_i = [\gamma_{0,0} + \gamma_{0,1} Z_{j,t} + \gamma_{1,0} X_{1ij,t} + \gamma_{11} Z_{j,t} X_{1j,t}] + [\mu_{0j} + \mu_{1j} X_{1j,t} + e_{ij}]$$

i=region 1,2,3,....*i*

j= country 1,2,3 ....j

t=2007-2009, 2010-2012, 2013-2015

(4)

Where polynomial $[\gamma_{00} + \gamma_{01} Z_j + \gamma_{10} X_{1ij} + \gamma_{11} Z_j, X_{1j}]$ is the group of coefficients in the regression that denote regression intercept (γ_{00}) and regression slopes (γ_{01}, γ_{10}, γ_{11}). As it is possible to note regression slope (γ_{01}) is predicted by the Level 2 explanatory variable (Z).

Polynomial $[\mu_{0j} + \mu_{1j} X_{1j} + e_{ij}]$ is the random component of the model and denotes the group of error terms of the equation. Note that e_{ij} is the error variance at level 1 (regions), μ_{0j} is the variance of the error at Level 1 (countries) or the variance of the intercept β_{0j} of equation (2) and μ_{1j} is the variance of the other Level 2 error or the variance of the slopes β_{1j}.

In the polynomial X denotes a vector of predictors that include the natural logarithm of region i nested in country j at the beginning of each time interval, percentage of labour force with tertiary education, population growth and investment rates by sector of economic activity. Z denotes the central government primary balance as percentage of trend GDP as the explanatory variable that predicts the "within group" random slope. The vector of variables includes also a dummy variable that takes on value 1 is the regions is located or "clustered" into Greece. Ireland is excluded from the sample.

Multilevel Mixed Effects Model are very useful to analyse grouped or hierarchical data because with this econometric techniques it is possible to calculate the intraclass correlation (ICC) and the random slope on the level two variable (Z or primary balance as percentage of trend GDP) for each group *j* of regions *i*.

Provided that fixed effects define the expected values of the observations and random effects define variances and the covariance of the observations (Littlel et al, 2000), the intraclass correlation is calculated as follows[28]:

[28] The results of the estimation of ICC are reported in Table 3.1 together with the regression output

$$ICC = \frac{Var(\mu 0j)}{Var(\mu 0j) + Var(eij)} \quad (2)$$

The intra-class correlation is a coefficient that accounts for the relatedness of clustered data by comparing the variance within clusters with the variance between clusters and is calculated as the ratio of the standard deviation (S.d.) of the random intercept to the sum of standard deviation of the random intercept itself plus the standard deviation of level-1 (regions) residuals.

So for example, in this case it can denote the ratio of the random deviation of Madrid Community's rate of growth from the mean rate of growth observed in the whole sample of 156 regions to the sum of the random deviation of Madrid Community's rate of growth itself plus the deviation of average rate growth observed in the Madrid Community from the average rate of growth of Spanish regions during the same period.

Therefore, an intraclass or intracluster correlation coefficient (ICC) is commonly used to quantify how much more similar outcomes are for individuals within clusters than for those in different clusters (Pagel et al, 2011).

An Intra-class correlation close to 0 would mean that observations within groups or clusters are not more similar to each other than observations across groups. Therefore, it would unnecessary to use a Multilevel Mixed model estimation for the panel dataset. As a consequence, the higher is the ICC, the more suitable is the multilevel estimation technique in order to infer the data of interest. Besides the relevance of intra-class correlation, application of multilevel estimation technique in this case is still needed because the objective of the model is to estimate how a variable at higher hierarchical level (austerity expressed as government primary balance to GDP) affects regional economic growth.

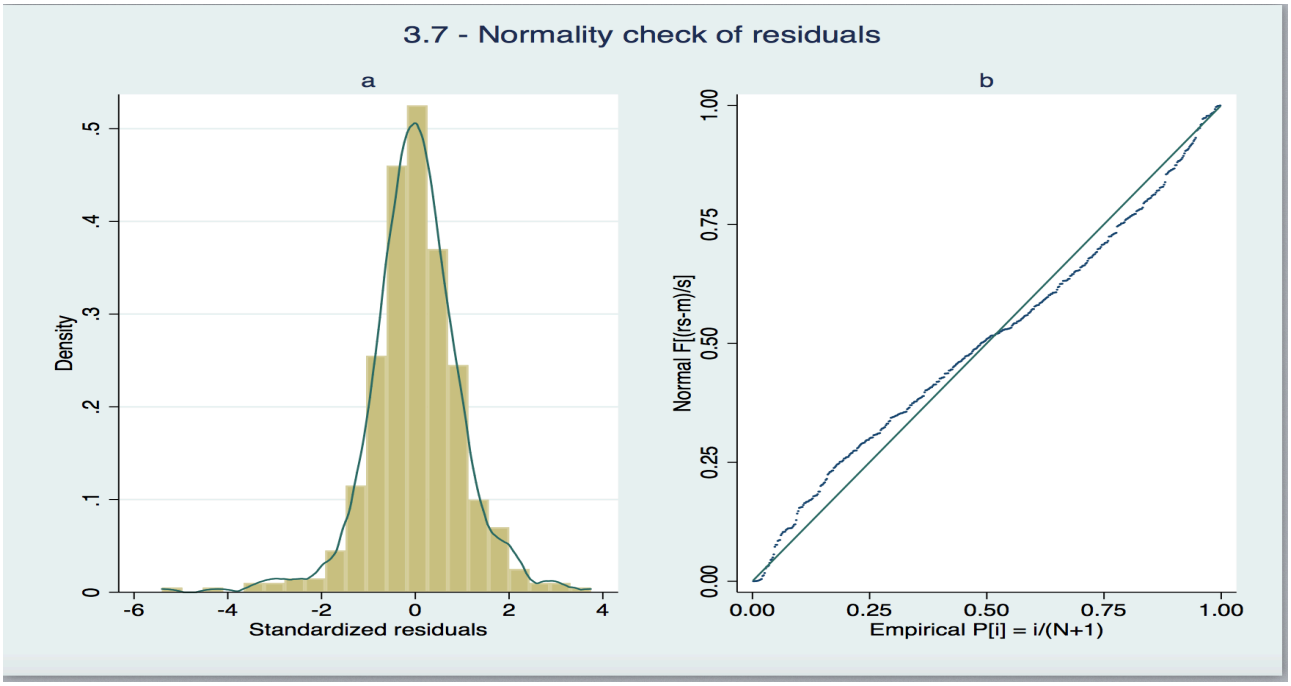
In the case of Model 3.1a, an intraclass or intracluster correlation equal to 0.57% means that almost 60% of the cross-regional variance in economic growth is determined by the fact that regions are nested within the same cluster. That is, almost 60% of cross-regional variance in economic growth is determined by the fact that regions are nested within different countries whose central government's policy affects within country regional economic growth.

Tab 3.1 Obs: 459	Sample Size=156 - T=3	Sample Size=156 - T=3
Dependent Variable: GDP per Capita Growth	a	b
Log of GDP per Capita t-T	-1.03***	-.76**
	[.39]	[.36]
Government primary balance to GDP	-.60***	-0.59***
	[.22]	[.20]
Total Investment to GDP	-	.008
		[.02]
Investment in manufacturing to GDP	.11***	-
	[.03]	
Investment in non-market services to GDP	-.039	-
	[.04]	
Investment in Market services to GDP	.092*	-
	[.05]	
Investment in Financial and Business services to GDP	-.026	-
	[.03]	
Share of Labour force with tertiary education	.039***	.037***
	[.01]	[.01]
Population Growth	-.03	-.036
	[.15]	[.15]
Dummy for Greece	-4.11***	-4.04
	[.80]	[.81]
Time Effects		
2010-2012	.80***	.82***
	[.17]	[.17]
2013-2015	2.22***	2.26
	[.26]	[.26]
Constant	8.33***	5.50
	[3.9]	[3.72]
Random Effects Parameters: Country		
S.d. Primary Balance to GDP	.55	.545
	[.13]	[.14]
S.d. Constant	1.42	1.39
	[.36]	[.36]
Corr (primar~e,_cons)	-.91	-.90
	[.12]	[.12]
S.d. Residual	1.06	1.07
	[.04]	[.04]
	ICC=1.42/(1.42+1.06)=0.57	**ICC=1.39/(1.39+1.07)=0.56**
	LR test vs. linear model: chi2(3) = 102.56	LR test vs. linear model: chi2(3) = 102.51
	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000
	Or	
	Likelihood-Ratio Test for best model fit:	Likelihood-Ratio Test for best model fit:
	LR chi2(2) = 57.32	LR chi2(1) = 47.81
	Prob > chi2 = 0.0000	Prob > chi2 = 0.0000

3.7 Model Post estimation and "within-country" slope decomposition

Multilevel regression technique estimates the parameters with the Maximum Likelihood (ML) estimation. As in all the linear regression models, one of the key assumptions of the Multilevel Mixed Effect model is that the residuals are normally distributed in the form i.d.d. e≅N(0, σ). Indeed, when residual errors are not normally distributed, the parameter estimates are still consistent and asymptotically unbiased but the standard errors are incorrect. As a consequence significance tests and confidence intervals cannot be trusted (Maas and Hox, 2004). Therefore in order to check if the model complies with this assumption of linear regression I calculate the average of the residuals (Table 3.3) and I the statistical distribution (Fig.3.7) of the residuals of model A with the investment rate disaggregated by sector of economic activity.

Tab 3.2	Obs	Mean	Standard Dev.	Min	Max
Residuals	468	0.000000000049	.98	-5.10	3.84



As it is possible to note, the mean is very close to 0 and the distribution of the residual errors approximates very well a normal distribution. Therefore it is possible to assert that the Multilevel Mixed Effects Model is correctly specified and correctly estimated.

After having empirically tested that the model satisfies linear regression assumption about the distribution of residuals, it is possible to obtain the values for the Random Effects part of the model that basically consists of the coefficients on level-2 variable Z (Government Primary Balance as percentage of GDP).

$$Y_i = [\gamma_{0,0} + \gamma_{0,1} Z_{j,t} + \gamma_{1,0} X_{1ij,t} + \gamma_{11} Z_{j,t} X_{1j,t}] + [\mu_{0j} + \mu_{1j} X_{1j,t} + e_{ij}] \quad (5)$$

Fixed Effects Random Effects

Therefore the current model is (according to model a):

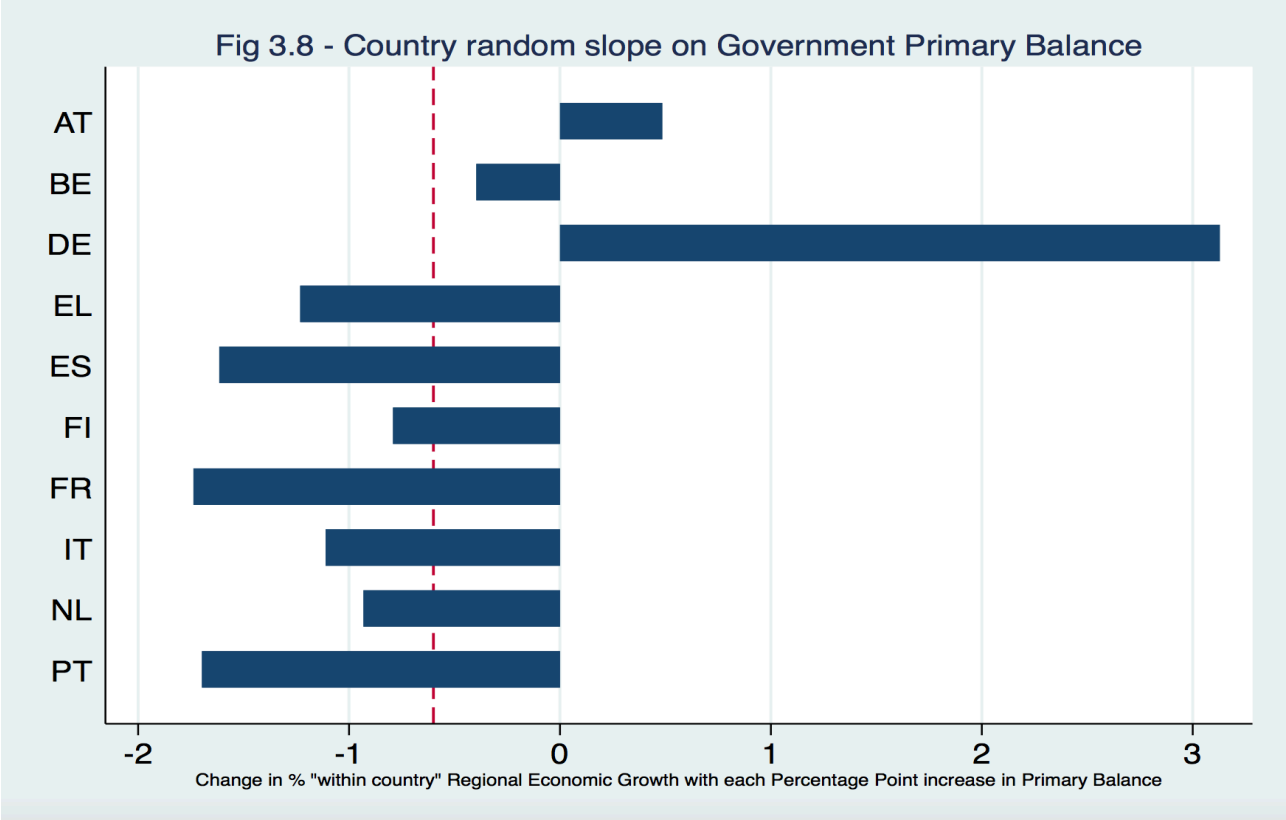
$$\text{Growth}_{ij} = -1.03 \text{ (Log of GDP)} - 0.60 \text{ (Primary balance}_{ij}) + 0.11 \text{ (Manufacturing)} + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + \mu_{0j} + \mu_{1j\ 1j,t} \text{ (Primary balance}_{ij}) + e_{ij}$$

Here the fitted slope for the whole sample (-0.60) can be discomposed and it is possible to predict the fitted random slope (on general government primary balance as percentage of trend GDP) for each group of regions clustered within countries.

Tab 3.3

Country	Fixed Effects Slope	Country Random Effects Slopes	Total Country Slope on each Primary Balance as Percentage of GDP (Fixed plus Random)
Austria	-.60	1.07	.47
Belgium	-.60	.19	-.41
Germany	-.60	3.7	3.1
Greece	-.60	-.64	-1.24
Spain	-.60	-1.02	-1.62
Finland	-.60	-.20	-.80
France	-.60	-1.12	-1.72
Italy	-.60	-.62	-1.22
Netherlands	-.60	-.34	-0.94
Portugal	-.60	-1.10	-1.70

As it is possible to note the random slope coefficients range from +3.7 (Germany) to -1.12 (France).



3.8 A Brief Discussion of the Results

The estimation of the fixed effect component of the regression equation suggests that fiscal consolidation after the Global Financial Crisis outbreak exerted generally negative effects on *within country* regional economic growth. Indeed, a coefficient estimate equal to -60% for the fixed effects component of the model means that one percentage point increase in general government primary balance produces a reduction of regional GDP equal to -0.60%. Indeed, here the coefficient estimate on general government primary balance represents the fitted slope for the whole sample of 156 regions. This first result matches the empirical evidence at country level outlined in Chapter 2 and according to which fiscal consolidation exerts negative effects on economic growth in the countries of the EMU.

Then, the estimation of the countries' random slopes on primary government balance as percentage of trend GDP reveals a very relevant empirical evidence that further confirms at regional level the empirical findings of Chapter 2. First austerity is actually "expansionary" only in Germany and Austria, where an increase in primary balance is respectively associated to a 3% and 0.45% increase in "within country" regional output. Second, the contractionary effect of austerity on "within-country" regional growth is larger in the peripheral countries and

France than in the other "core" countries like Finland (-0.8%), Netherlands (-0.9%) and Belgium (-0.45%). In the peripheral economies and France each percentage point of fiscal consolidation is associated to a drop in regional GDP much larger than one percentage point. However, France did not apply the same degree of austerity as the peripheral countries like Italy because the country recorded negative primary balance throughout the period of the crisis (and could reduce its primary government deficit more gradually than Spain). Furthermore, during the period of the continental "recovery" (2013-2015) France recorded a government primary deficit well below -1% (Fig 2.5, Chapter 2). Therefore, the "*within country*" slope decomposition, as in the case of the interaction term in model 2.3 (Table 2.2) of Chapter 2, confirms that fiscal austerity prejudices convergence within the EMU because it affects harder the poorer regions located in the countries that are supposed to catch-up in terms of income per capital with the riches ones.

3.9 Conclusions

Starting from the empirical evidence of Chapter 2, I tested the hypothesis that government fiscal consolidation during the crisis time intervals comprised between 2007 and 2015 has been one of the main determinants of the process of regional divergence observed in the European Union since the introduction of the Single Currency.

Indeed one percentage point of fiscal consolidation has been associated on average to a 0.60% drop in GDP in regional growth in the whole sample of 156 NUTS regions. However, the disaggregate slopes on government primary balances show that government fiscal consolidation has produced asymmetric outcomes within the different countries after the outbreak of the Global Financial Crisis. Indeed, fiscal consolidation in peripheral countries and France is much more harmful to regional economic than in countries like Finland, Belgium and the Netherlands. Contrariwise fiscal consolidation exerted positive effects on regional economic growth in Germany and Austria.

Therefore the results of this analysis allow drawing at least two considerations. First, austerity was the main cause of the double dip recession observed in many countries of the EMU (especially the peripheral ones). The empirical evidence at regional level derived from the model confirms the analysis of De Long and Summers (2012) according to which policies of deficit reduction in the presence of substantial output shortfalls have adverse impacts on the economy both in the short and long run. In this framework the authors advocate in favour of substantial caution regarding the pace of fiscal consolidation in depressed economies where interest rates are constrained by a zero lower bound, as in the case of the EMU countries after the launch of the Public Sector Purchase Programme by the European Central Bank in 2015.

Second, austerity may be regarded as the main culprit for the lack of regional convergence over the period 2008-2015. Indeed, given the fact that the financial crisis of 2007-2008 was initially "global", economic growth should have been affected symmetrically in all the European countries. However empirical evidence shows that, because of fiscal austerity, the Global Financial Crisis hit in particular those regions located within the peripheral economies that were supposed to convergence.

Besides the main finding related to the asymmetrical affect of government fiscal consolidation on regional economic growth, the results of this research also show that investment in manufacturing industry was the main driver of regional economic growth during the double dip recession and the period of recovery. Indeed I first estimated the model with aggregate investment rate as a predictor of economic growth (3.1a), but coefficient estimate is not statistically significant. Then I have disaggregated investment rate to GDP and estimated the model including its three main components (manufacturing industry, market services and non-market services) and I have showed that investment rate composition matters. In fact the regression output in Table 3.1a implicitly confirms the findings of Fürst (2013) and Reiner (2012) that empirically find out that countries with large manufacturing industrial sectors performed much better than others since the outbreak of the Global Financial Crisis.

For this reason in the next chapter I will specifically analyse the role of played by the manufacturing sector in shaping long-run regional economic performances since the early 2000s and through the global financial crisis and the fiscal austerity-induced double dip recession in Europe.

Appendix 3.1: Disadvantage of being in a monetary union during a financial crisis

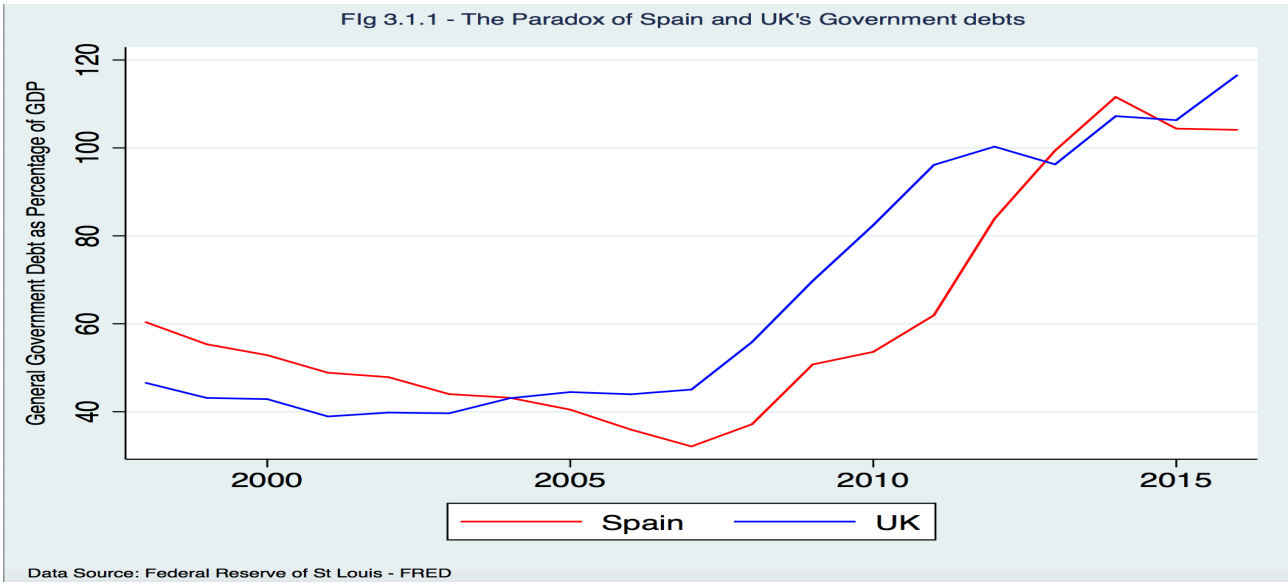
De Grauwe and Ji (2013c) assert that the European Monetary Union exacerbated the dysfunctions previously embedded in the European Monetary System (ESM) that existed between 1979 and 1999.

Before the European Monetary Union, the EMS was a pegged exchange rates arrangement in which national central banks promised to convert domestic currency into a foreign currency at a fixed price.

The problem arose when central banks had not foreign currency (Deutsche marks) to purchase domestic currency and sustain the fixed exchange rate. The necessity to attract foreign currency to restore their reserves together with capital flight induced by the lack of investors' confidence about the ability of central banks to meet their obligations resulted in high interest rates in the periphery of the European Monetary Union. By joining the Euro Area, national governments made a similar promise, that is, to convert their liabilities (government bonds) into "foreign" currency over which they have not control and this has generated similar fragility as in the case of the EMS. The fear that government could run out money to convert its treasury bonds into currency may trigger massive sales of government bonds issued in the weaker countries, speculative attacks and self-fulfilling prophecies about government default on its debt obligations.

Therefore in absence of a lender of last resort, negative market sentiment can turn a liquidity crisis into solvency crisis or even a default. De Grauwe and Ji (2018) remark, the countries of Economic and Monetary Union that got into troubles during the exchange rate crisis in 1992 are broadly the same as the countries that got into troubles during the sovereign debt crisis.

In order to describe the fragility of the Euro Area, De Grauwe (2011) provides the paradoxical example of the evolution of general government debt in the United Kingdom and Spain through the Global Financial Crisis.



As can be observed in Figure 3a.1, at the beginning of the financial crisis in 2007-08 the government debt to GDP ratio increased more in the United Kingdom than in Spain. Furthermore, when Spain was gradually losing market access under the speculative attacks on its sovereign bonds and was forced to request conditional financial assistance to Euro Group on June 2012 in order to recapitalize the banking system, its debt to GPD ratio stood 16% lower than the one in the UK. Given this evidence, De Grauwe (2011) argues that this different evaluation of default risk for the two countries depended on the fact that Spain belongs to a monetary union.

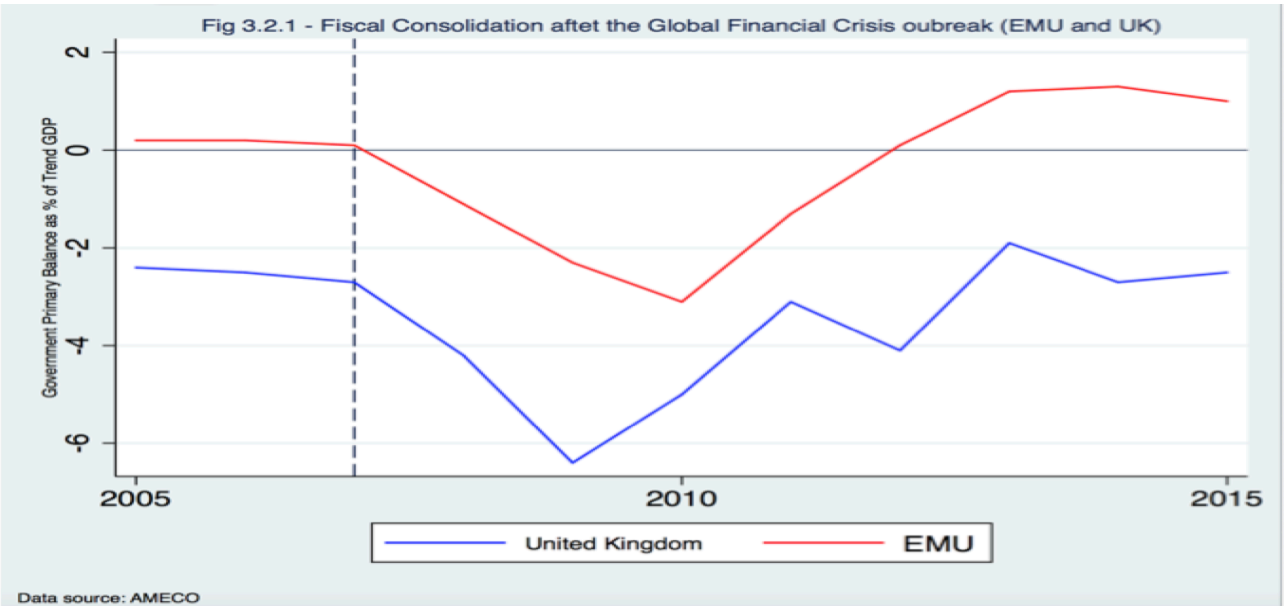
Appendix 3.2 - Fiscal consolidation after the Global Financial Crisis outbreak in the EMU and in the UK

As in the case of the comparison of the annual government primary balance in the EMU and in the US in Chapter 2, in Figure 3.2.1 I compare the evolution of government primary balance in the UK and in the EMU since the outbreak of the Global Financial Crisis in 2007-08. Note that, here as in Figure 2.2 in Chapter 2, primary government balance in the EMU denotes the aggregate sum of total revenue minus total expenditures (excluding interest expenditures) in the whole monetary area. Therefore an improvement of EMU primary balance represents the sum of the primary balances improvements taking place in the member states of the Economic and Monetary Union.

As it possible to note in the figure, since 1995 the United Kingdom recorded a negative primary that dropped below -6% during the peak of the crisis that hit its banking system and involved British government intervention with a rescue package worth roughly £500 billion (King, 2015).

This massive rescue of the banking system together with the economic downturn consequently led to an abrupt increase in the British government debt to GDP ratio as shown in Figure 3.1.1 in Appendix 3.1.

However, despite such a sharp increase in the stock of government debt, the British government was not pressured by financial markets to consolidate its primary balance in order not to lose the access to the financial market to finance its public debt. On the contrary given the peculiar structure of the Economic and Monetary Union with the implicit absence of a lender of last resort, all the member states and the weaker ones in particular were forced with different grades of intensity to implement recessionary measures of fiscal consolidation (De Grawe and Ji, 2018; Pasimeni, 2015; De Grauwe and Ji, 2015a and 2015b; De Grauwe and Ji, 2013c).



Chapter 4

Regional distribution and relocation of Manufacturing Industry as a crucial aspect of the shift of economic convergence from the Periphery of the EMU to CEE countries

4.1 Introduction

In the first chapter, by testing "absolute beta convergence" I showed that the convergence process between the EU-15 countries has gradually faded away as long as the process of economic and monetary integration has intensified during the early 1990s (Table 1.2, Chapter 1). As matter of facts when the sub-periods period 1999-2008 and 2009-2018 are taken into account allowing the introduction of the single currency to interact with the natural logarithm of GDP per capita at the beginning of each time interval, it is possible to observe a process of statistically significant divergence between the countries under analysis. As a consequence the group of the "Western" EU countries no longer configures as a convergence club in the Baumol's (1986) and DeLong's (1988) significations. Rather income convergence has been observable only between the CEE economies and the "Northern" countries of the EU-15 meaning that the European "convergence club" is actually driven by the New Member States since the mid of the 1990s. In other words, the process of European monetary integration in the EU-15 and the enlargement have been accompanied by the shift of income convergence from the periphery of the EMU to Central and Eastern European countries. Starting form this empirical evidence I have tested the hypothesis that the interruption of convergence within the EU-15 economies since the mid of the 1990's could be attributed fiscal rules established by the Maastricht Treaty for the countries in order to join the Euro and avoid financial crises during their permanence in the Euro group. According to the regression output (Table 2.2, Chapter 2) the market discipline for government and permanent fiscal consolidation have affected growth particularly in the peripheral countries that were supposed to catch-up with the richer ones.

The results of Chapter 2 are further confirmed in the analysis of chapter 3 where I estimated a multilevel mixed effects model in order to show how government fiscal "austerity" since the financial crisis outbreak in 2007 produced the double dip recession in Europe. In particular I showed that fiscal austerity is the main culprit for the pattern of regional divergence in the EMU-12 during the period 2007-2015.

However, besides strict government fiscal policy and austerity, there exist other factors such as economic structures, mobility of the factors of produciton, the size of industry and geography may that impact convergence in income per capita and labour productivity in particular (Buti and Turrini, 2015; Martin, 2001; Krugman and Venables, 1995; Krugman, 1991a).

Indeed, in the *Kaldorian* economics theoretical framework, manufacturing industry is the engine of economic development because there exists a strict positive relationship between the size of manufacturing sector, labour productivity growth in manufacturing and economic growth (Pons-Novell and Viladecans-Marsal, 1998; Kaldor, 1975 and 1998).

Also the European Commission (2014), despite the progressive reduction of manufacturing share of GVA and employment observed since the 1970s in most of the advanced economies, has recognized the crucial importance of the manufacturing industry for creating growth, jobs opportunities and innovation. For this reason the European Commission called for an action aimed at industrial renaissance in Europe with the objective to raise the share of manufacturing on total GVA to 20% by 2020.

As matter of facts, Veugelers (2017) remarks that manufactured goods are more tradable than services and as a consequence manufacturing remains an important contributor to economies' trade balances and external competitiveness. Manufacturing exports still represent more than two thirds of total EU exports.

Despite the reduction of manufacturing share of total GVA in the EU has been less pronounced than in other advanced economies like the US, a process of recomposition and relocation of the geographical distribution of manufacturing activity was observed across countries and regions within the European Union since the end of the 1990s. As matter of facts in the EMU during the period 2001-2015 the manufacturing share of total GVA shrank in most of the French, Italian and Greek regions and remained stable in most of Spanish and Portuguese regions[29]. Symmetrically the manufacturing share of total GVA increased remarkably in the regions of Germany, Austria and of the countries of the Visegrad Group. As a consequence a process delocation/relocation has changed the location of the European manufacturing industry beneficiating the "core" regions and bringing spatial concentration of industrial activity in Europe (Alvarez-Lopez et al, 2011).

Therefore, given the fact that the process of recomposition/relocation of the geographical distribution of manufacturing activity was accompanied by the progressive geographical South-East "bifurcation" of convergence around the core, in this chapter I will test the hypothesis that the shift of the convergence process from Southern Europe to CEE countries highlighted in the 1st chapter is also the consequence of a progressive polarization of manufacturing activity around the a European core of regions that has occurred since the early 2000s in coincidence with the EU enlargement.

In order to test this hypothesis in this chapter I will propose three spatial models to study the process of regional development in Europe since the early 2000s.

With the first spatial model I will analyse the process of regional concentration of manufacturing activity in Europe and show the positive and statistically significant relationship between the regional investment rate in manufacturing industry, the initial size of manufacturing industry and neighbourhood spillovers.

[29] In the statistical map of Appendix 4.3 I show the changes in manufacturing share of total GVA occurred in the European regions during the period 2001-2015

With the second spatial model I will infer the relationship between regional growth of manufacturing industry size, its spatial location and growth in output per worker in manufacturing industry or overall labour productivity. Finally, with the third model I will analyse the determinants of regional economic growth in the EU and I will show that investment rate in manufacturing industry is a key driver of economic growth in EU.

4.2 Literature Review

Since the signature and Maastricht Treaty (1992) and the EU Enlargement, 19 of the 28 of the European Union member states have progressively joined the Single Currency (EMU). However, after some decades of convergence *between* and *within* countries as documented by Barro and Sala-i-Martin (1991), in the 2000s a process of divergence *between* countries has coincided with the beginning of a process of regional divergence *within* and *across* countries (Wunsch, 2013. Ascani, 2012). Indeed, as Martin (2001:1) points out, much of the discussion surrounding the formation of "Euroland" focused on the nominal convergence criteria but far less attention was directed at the role and significance of real economic conditions, such as output growth, productivity, economic structures, employment or unemployment. In this framework, Bianchi (1995) remarked that the creation of an economic and monetary union entailed risks of a progressive polarization in the levels of economic development across European regions.

Despite some have argued that the technological progress and capital mobility have de facto determined the "*end of geography*" (O'Brein, 1992), the opposite seems to be the case when it comes to the analysis of regional development in Europe. Indeed, in the case of the EU, as in the case of the US, it is well documented that productivity and innovation tend to be highly concentrated in a core of regions. As a consequence, poorer regions tend to lag behind while most prosperous areas exhibit sustained growth (Ascani et al, 2012).

This trend of regional divergence among integrated areas is an economic phenomenon that has been widely explored within the theoretical framework of *New Economic Geography* (Krugman, 2011).

New Economic Geography theories differs from International Trade theories because the latter treat economic areas as dimensionless points while the former allows to take into account the role played by "*the location in space*" of the factors of production (Krugman, 2009). Therefore in *New Economic Geography* theoretical framework, "space" or geographic location becomes recognized as a crucial factor contributing to economic development and growth (Krugman and Venables, 1995).

As a consequence, in a context of mobility of production factors it is likely to observe the emergence of a self-reinforcing core-periphery pattern with an industrialized "core" and less productive periphery whose regional

economic structures tend to specialize in non-tradable sector or market services sector like retail, wholesale and tourism. Indeed, in order to realize scale economies and minimize transport costs, manufacturing firms tend to locate in regions with larger demand, but the size of the demand itself depend on the distribution of manufacturing (Krugman, 1991a: 483)[30].

Krugman and Venables (1995:861) in their model consider two regions where a region has a larger manufacturing sector than the other. The former offers a larger market for intermediate goods and this makes the region more attractive to locate the production of such goods. But if this region produces a wider range of intermediate goods than the other, a better access to these goods will mean lower costs of production of final goods, leading a further shift of manufacturing from the less industrialized region to the more industrialized one. In this framework, trade liberalization creates further incentives for the industry to concentrate in the central region, near the larger market (Krugman, 1991b, Krugman and Venables, 1990).

For example Álvarez López et al (2011) empirically find out that the process of industrial delocation observed in many European countries and regions has contributed to concentrating European manufacturing industry in the areas with higher market potential, in the centre of continental Europe. The authors also empirically demonstrate the existence of a positive relationship between regional advances of industrial productivity and the attractiveness for new manufacturing firms. As remarked also Hanson (2009:485) showed, after controlling for differences in labour costs, tax rates and trade openness, investment activity of domestic and foreign firms is higher in the geographical areas with larger markets, a larger concentration of foreign firms and higher quality of infrastructures. Therefore firms are attracted to locations that have large concentrations in their industry or related industries. Indeed, locating within an industrial cluster can provide firms with superior or lower-cost access to specialized inputs such as components, machinery, business services, and personnel, as compared to the alternatives - vertical integration, formal alliances with outside entities, or "importing" inputs from distant locations. The industrial cluster represents a spatial organizational form that can be an inherently more efficient or effective means of assembling inputs if competitive local suppliers are available (Porter, 2009:259).

Therefore, high mobility of factors of production entailed by the progressive economic integration may inherently produce divergent rates of economic growth over time (Krugman, 1993).

Also Friesenbichler and Glocker (2018) and Stöllinger (2016) argue that there exists a "*manufacturing divide*" in the European Union and that the relative decline in the manufacturing sector represents an unfavourable shift. The structural impact of European economic integration has strengthened the manufacturing sector in the "core"

[30] Despite it is not possible to speak of an "agricultural" periphery, as I will show in the statistical maps it is possible to notice how Europe has become divided into a core area with prevalence of manufacturing and a periphery with a prevalence of services, retail and government as percentage of Gross Value Added.

and the surrounding regions of CEE countries and reduced its size in the periphery. This process of asymmetric industrialization is a relevant factor of regional divergence in GDP per Capita and labour productivity.

4.3 The dataset

Data concerning economic growth (GDP per Capita and GVA per Worker) and sectorial investment rates or sectorial GVA share on the total economy are sourced from the Cambridge Econometrics European Regional Database 2017.

Data concerning human capital (educational attainment of the population) and social development (young people neither employed nor in education and training) are sourced from the open access database provided by Eurostat. The annual data are averaged from 2001 to 2015 for the sampling units and the sample of 272 units includes 15 NUTS-1 territories (Belgium: Brussels; Germany: Brandenburg, Bremen, Hamburg, Mecklenburg-Vorpommern, Saarland, Sachsen-Anhalt, Schleswig-Holstein and Turingen; Spain: Community of Madrid; France: Ile-de-France and Nord-pas-de-Calais; Greece: Attika; Hungary: Central Hungary-Budapest; United Kingdom: Northern Ireland), 4 NUTS-0 territories (Luxembourg, Estonia, Latvia and Lithuania[31]) and 253 NUTS-2 regions, comprising 7 NUTS-2 Norwegian regions[32,].

I use 15 NUT-1 because Cambridge Econometrics European Regional Database for those territories does not provide neither NUTS-2 nor NUT-3 sub-regional data. For three Baltic States and Luxemburg data are available only at NUTS-0 level (country level).

Cambridge Econometrics ERD 2017 contains data until the year 2015, therefore I have to limit my analysis to the period 2001-2015 without being able to extend the analysis to the year 2018 as in Chapters 1 and 2.

I chose the period 2001-2015 because data for educational attainment of the population and social development are not available during the 1990s for the most of CEE regions. Furthermore, I am interested in analysing regional growth and convergence in the European Union since the advent of the single currency and the EU enlargement that took place at the very end of the 1990s.

4.5 Some Stylized Facts about Regional absolute Beta-Convergence 2001-2015

Figure 4.1 that displays the process of regional convergence essentially matches Figure 1.7 (Chapter 1) that shows convergence (and divergence) between countries. Convergence has been taking place in the EU-28 as a whole but EU15 (and EMU-12) countries and regions have diverged.

[32] For a more detailed list of the territorial units in the sample see Table 1 of appendix 4.1

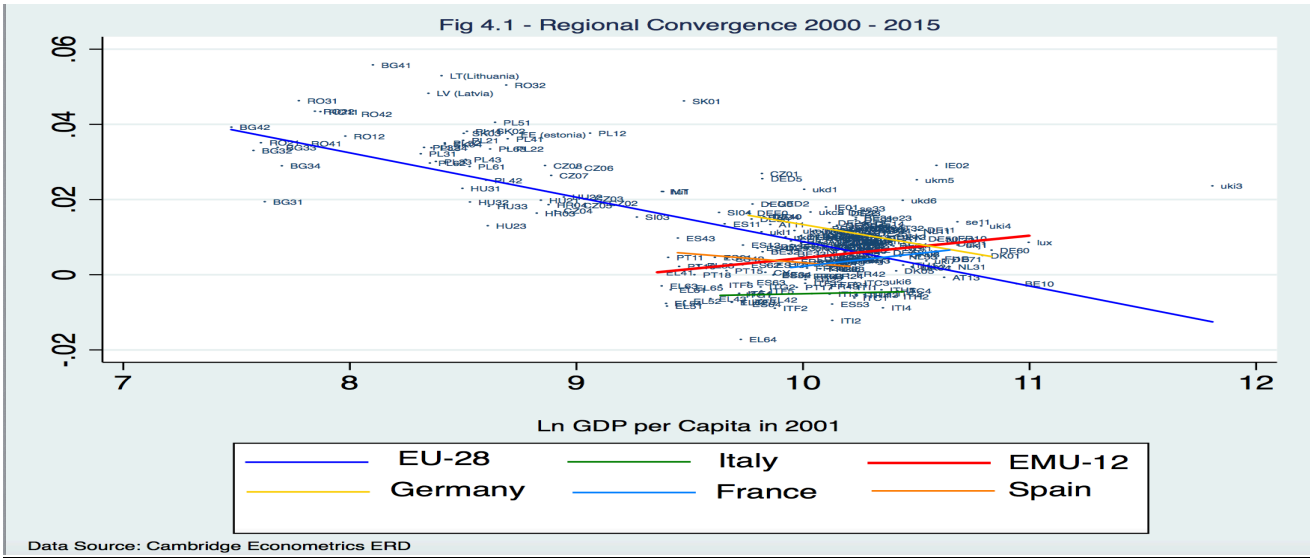


Table 4.1 reports the estimations of the coefficients of regional absolute beta- convergence within the EU-28 and within a set of relevant sub-groups of regions.

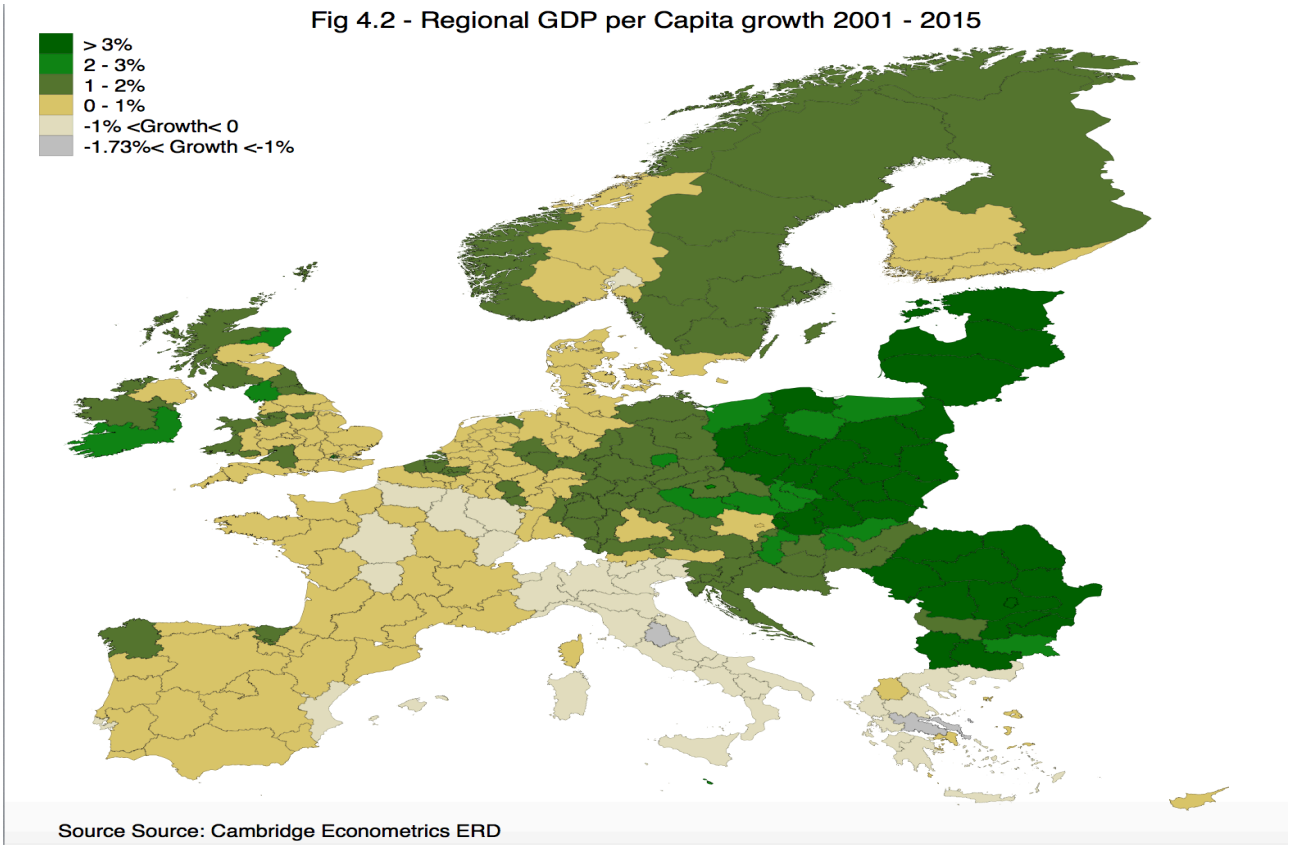
Table 4.1
Dependent Variable: Regional GDP per Capita growth 2001-2015

	EU-28	EMU-12	German plus Visegrád Group, Austrian and Dutch Regions	Germany	Italy	Spain	France
Ln GDP per capita in 2001	-.0115*** [.0007]	.005*** [.001]	-.0116*** [.001]	-.010*** [.002]	.001 [.002]	-.004 [.006]	.006 [.005]
Intercept	.12*** [.007[	-.05*** [.01[	.12*** [.008]	.11*** [.2]	-.016 [.02]	.05 [.006]	-.06 [.05]
R^2	.43	.17	0.65	.34	.01	.03	.07

Statistically Significant at 1%
Standard Errors in parentheses

As it is possible to note, regional absolute beta-convergence has been strong in the EU-28 and between the group that includes Germany, Austria, Netherlands and Visegrád countries. Convergence has been also observed between the German regions. Conversely regions in the EMU-12 have diverged at a statistically significant rate. Figure 4.2 shows the shift of regional convergence from Southern Europe to CEE regions.

Fig 4.2 - Regional GDP per Capita growth 2001 - 2015



Source Source: Cambridge Econometrics ERD

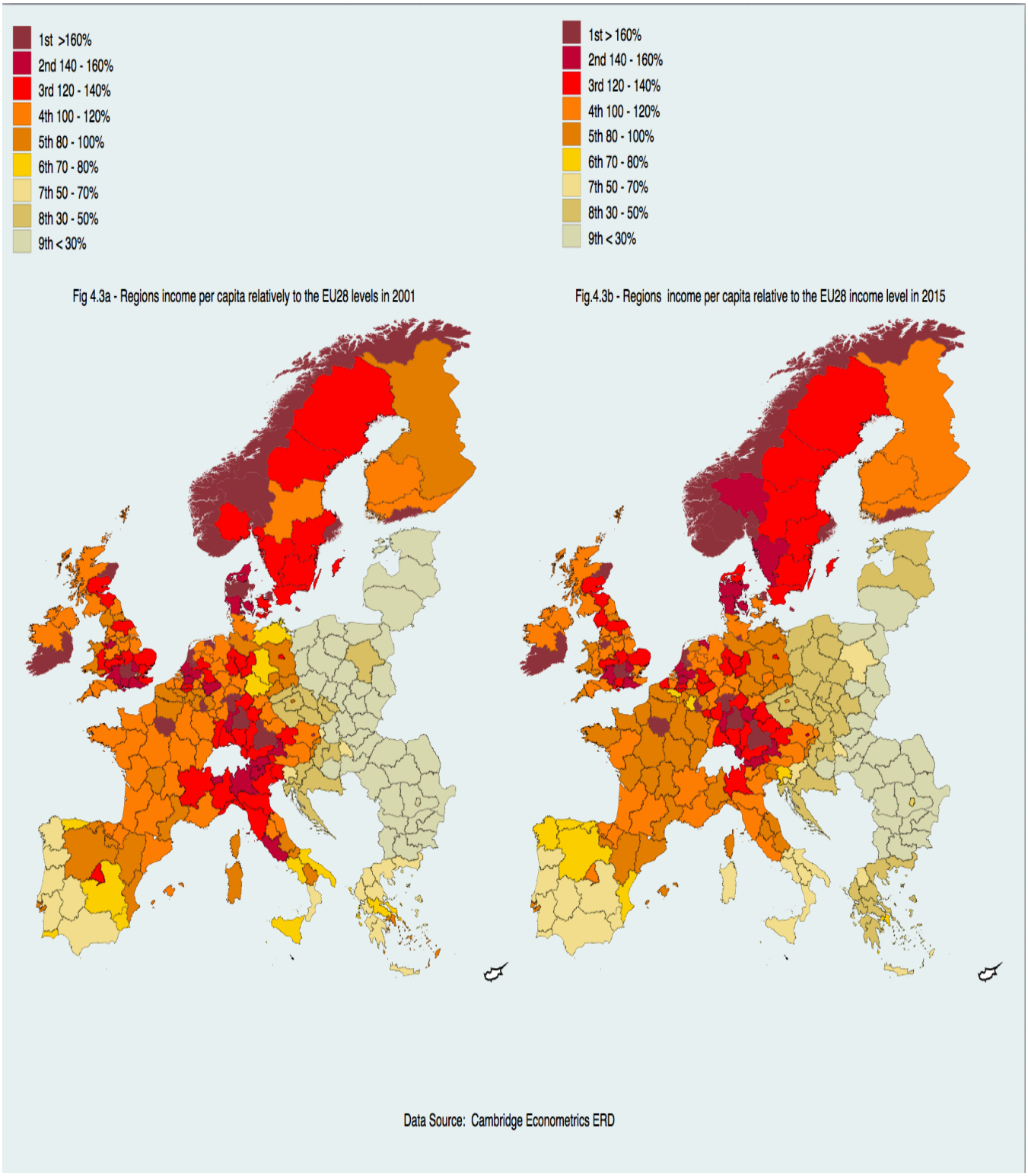
As it possible to note, convergence concentred in the regions Visegrad group while most of the Southern European Regions actually diverged from the Northern European regions, in the sense that the Southern regions of the EMU underperformed the Northern ones. In the above map it is apparent that, excluding Spanish region Galicia and Basque Community that recorded average rates of growth between 1 and 2%, economic growth in the EMU-12 concentrated in the Benelux area and mostly in the German and Austrian regions that are placed close to the fast growing regions of Eastern Europe.

Symmetrically, almost all Iberian peninsular regions and most of French regions recorded rates of growth comprised between 0 and 1%, while almost the totality of the Italian and Greek regions recorded negative rates of growth comprised between 0 and -1%.

These unbalanced and asymmetrical regional performances have changed the geography of regional income distribution in the European Monetary Union that has become increasingly concentrated in the regions of Benelux and Germany and Austria.

In Figure 4.3, regions are sorted in 9 groups according to their income per capita levels (as percentage of to the European Union income per capita) and it is shown how economic development in the European Monetary Union has increasingly concentrated in the regions of Germany, Austria, Benelux and Finland.

Symmetrically, regions located in the periphery of the monetary union have experienced a decline in the level of income per capita.



As it possible to note in the figures 4.3a a and 4.3 b, between 2000 and 2015 wealth has tended to move from the peripheral countries towards the core countries of the EMU whose regions classify in the higher ranks of income per capita in relation to the European Union income per capita.

In this regard, Italy represents an extreme and emblematic case of the tendency by which a progressive shift of income per capita from south to north is observed *between* and *within* countries. While in 2000 the income per capita in all the Northern Italian regions ranked in the third group of regions (see map 1.6a - income per capita between 120 and 140% of the EU income) with Lombardy and Lazio ranking in the 2nd group (income per capita between 140 and 160%), in 2015 Lombardy ranked in the 3rd group (see map 1.6b) with the most of Northern Regions and Lazio ranking in the 4th group (see map 1.6b) and Piedmont ranking in the 5th group of regions by relative income per capita (see map 1.6b - income per capita between 80 and 100% of the EU income per capita). Symmetrically also the Italian *Mezzogiorno* experienced a sharp squeeze in income per capita relative to the European Union: in 2000 Puglia, Campania and Sicily classified in the 6th group of regions (income between 70 and 80% of the EU income per capita) with Sardinia raking in the 5th group of regions (income between 80 and 100% of the EU income per capita). In 2015 all the regions of Italian *Mezzogiorno* ranked in the 7th group of regions income per capita (income between 50 and 70% of the EU income per capita).

Although with lower intensity than Italian regions, also Spanish regions partially experienced similar patterns. In the North Eastern macro area, Catalonia switched from the 4th group in 2000 (income between 100 and 120% of the EU income per capita) to the 5th group of regions (income per capita between 80 and 100% of the EU income per capita) in 2015. In the same period, Valencian Community switched from the 5th group in 2000 to the 6th group of regions (income between 70 and 80% of the EU income per capita) in 2015. In the same year in the North-East area only Aragon, Navarra and Basque Community had maintained the same position held in 2000. Also the income per capita of the Community of Madrid, Castilla-La Mancha and Murcia declined by one position relatively to the European Union income per capita while during the same period all the Southern regions maintained the same income per capita comprised between 50 and 70% of the European GDP per capita.

The most alarming figure concerns Greece whose richest region in 2000 (Attica) ranked in the 5th group in 2015 while most of the regions, excluding Crete and Epirus, had switched from the 7th group (income between 50 and 70% of the EU income per capita) to the 8th regional group (income between 30 and 50% of the EU income per capita).

Overall, most of the poor regions (and countries) that during the period 2000-2015 experienced an increase of income per capita relative to the European Union's GDP per capita are located in Eastern Europe: Slovakia and

the Baltic states that joined the EMU in recent years and Czech Republic, Poland and Hungary that opted to remain out of the EMU.

4.6 Labour Productivity, GDP per Capita and Manufacturing Industry

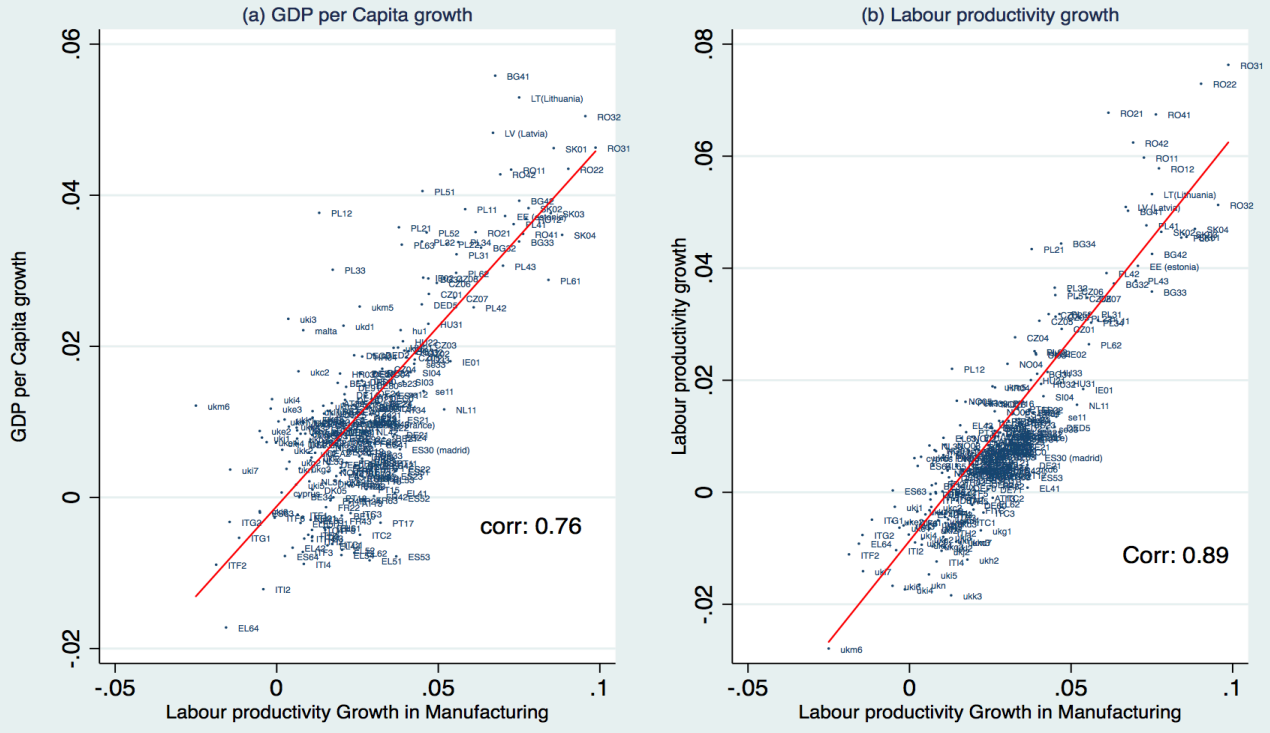
First Kaldor's law asserts that manufacturing is the engine of economic growth (Kaldor, 1975, 1966 and 1968). Thus economic areas or regions with high rates of productivity growth in the manufacturing sector will also record higher rates of overall economic growth (in terms of GDP per Capita and Labour productivity) than will the economies with slow growth of productivity in manufacturing sector (Bernat, 1996:463).

As Pons-Novel and Viladecans-Marsal (1998) remark, there is always a positive relation between economic growth and output growth in the manufacturing industry or its share in the whole economy.

Empirical evidence at regional level in the European Union seems to confirm Kaldor's assumptions.

The tight positive relationship between GDP per Capita (and overall labour productivity) and productivity growth in manufacturing industry is shown in the graphs 4.4a and 4.4b[33].

Fig 4.4 - Economic growth and labour productivity in manufacturing industry (2001-2015)



Data Source: Cambridge Econometrics ERD

[33] Labour Productivity is calculated as the overall GVA divided by the total number of employees. Labour Productivity in Manufacturing Industry is calculated as the total GVA produced by the industrial sector divided by the number of the employees in the industrial sector.

The graphical evidence is confirmed also by remarkably large correlation coefficients. A correlation coefficient equal to 0.89 means that there exists almost a perfect liner relationship between growth in industrial labour productivity and overall labour productivity in the economy. This empirical evidence confirms the suitability of the First Kaldor's law to explain the patterns of growth observed across the regions of the European Union during the period 2001-2005.

Furthermore, if I plot the convergence line in labour productivity in manufacturing industry as in Rodrik (2013), it is possible to note that this process essentially matched the process of regional absolute beta-convergence in GDP per Capita and output per worker. EU-28 regions that have experienced sustained convergence in labour productivity in manufacturing industry are mostly the CEE regions that experienced convergence in income per capita. Regions that did not experience convergence in manufacturing industry are mostly the Southern Regions of the EMU (and partially British regions) that are the regions that actually diverged in terms of GDP per Capita (Fig. 4.5).

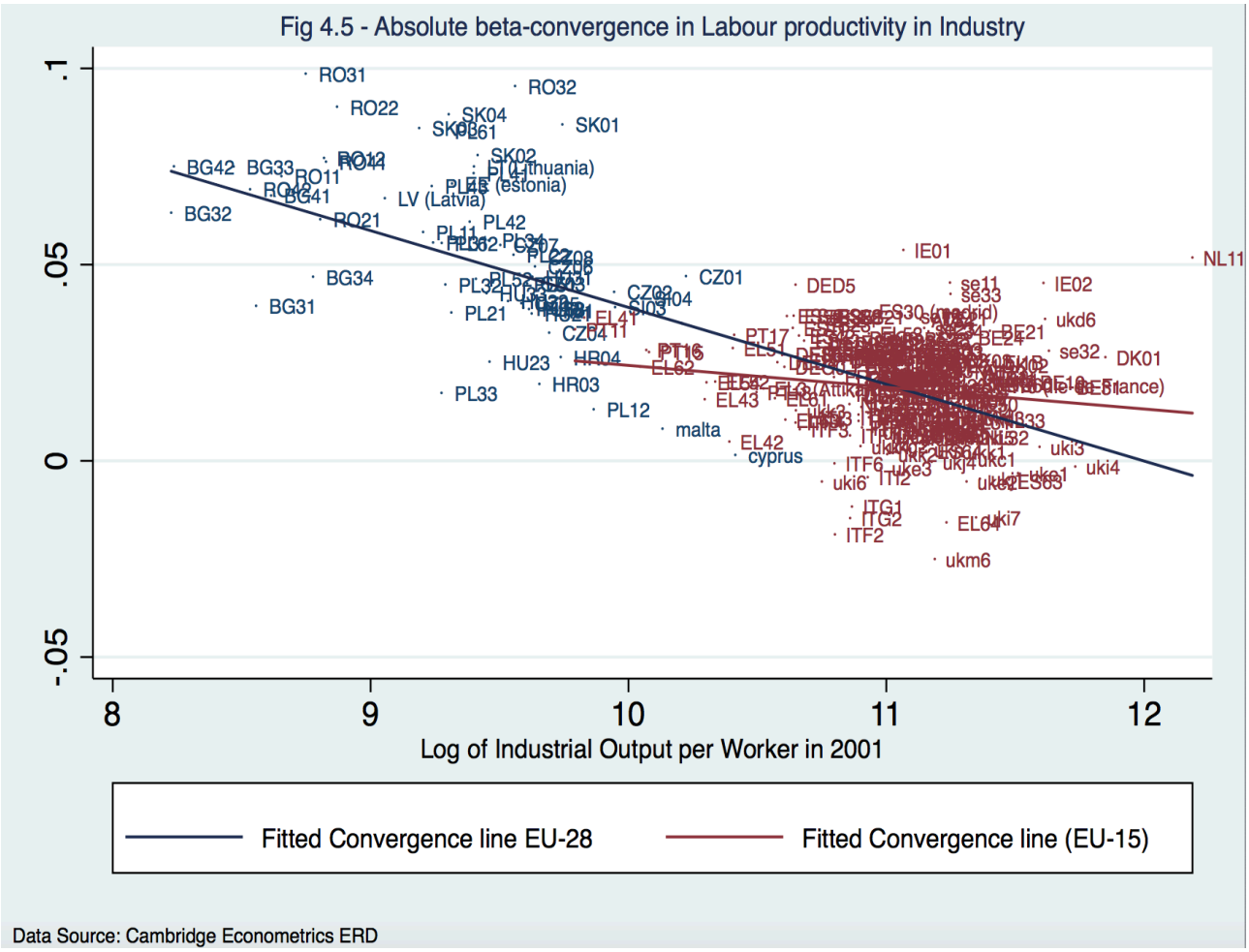


Table 4.2 reports the estimations of absolute beta-convergence in industrial labour productivity across the regions of the European Union and the different sub-groups.

Table 4.2 – Regional Absolute Beta-Convergence in Labour Productivity in Industry, Overall Labour productivity and GDP per Capita

	EU-28	NMS	EU-15	EMU-12
Log of Output per Worker in Industry in 2001	-.0180*** [.001]	-.025*** [.001]	-.001 [.002]	-.002 [.002]
Intercept	.21*** [.01]	.29*** [.01]	.041 [.02]	.05 [.03]
R^2	0.49	.72	.004	.005
Log of Output per Worker in 2001	-.019*** [.000]	-.024*** [.00]	-.001 [.001]	-.006** [.002]
Intercept	.21*** [.008]	.26*** [.01]	.02 [.01]	.08*** [.02]
R^2	.66	.78	.006	0.08
Log of GDP per Capita in 2001	-.0114*** [.0007]	-.0110*** [.0009]	.0056*** [.001]	.006*** [.001]
Intercept	.12*** [.007]	.12 [.008]	-.051*** [.01]	-.054 *** [.01]
R^2	.44	.59	.06	.06

*** Statistically Significant at 1% ** Statistically Significant at 5%
Standard Errors in Parentheses

Absolute beta-convergence estimates reported in Table 4.2 show how regional convergence in labour productivity in manufacturing industry matched the patterns of absolute beta-convergence in GDP per capita and overall labour productivity across the European regions. In the EU-28 sustained rates of convergence in industrial labour productivity have been associated to sustained rates of convergence in GDP per Capita and overall labour productivity. In the EU-15 and EMU-12, the absence of convergence in industrial labour productivity has been associated to patterns of divergence or negligible convergence (as in the case of EMU-12 regions) in overall labour productivity and GDP per Capita. In other words, statistical evidence suggests that during the period under analysis the regions that have converged in terms GDP per capita and overall labour productivity have been the regions that have converged in the labour productivity of manufacturing industry.

Fig 4.5a - Absolute beta-convergence in Labour productivity in Industry

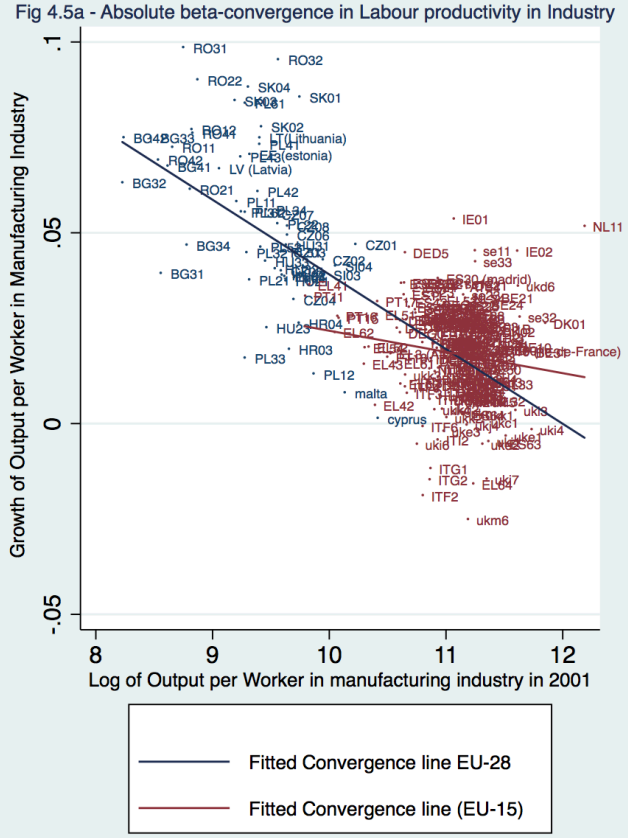


Fig 4.5a - Absolute beta-convergence in GDP per Capita

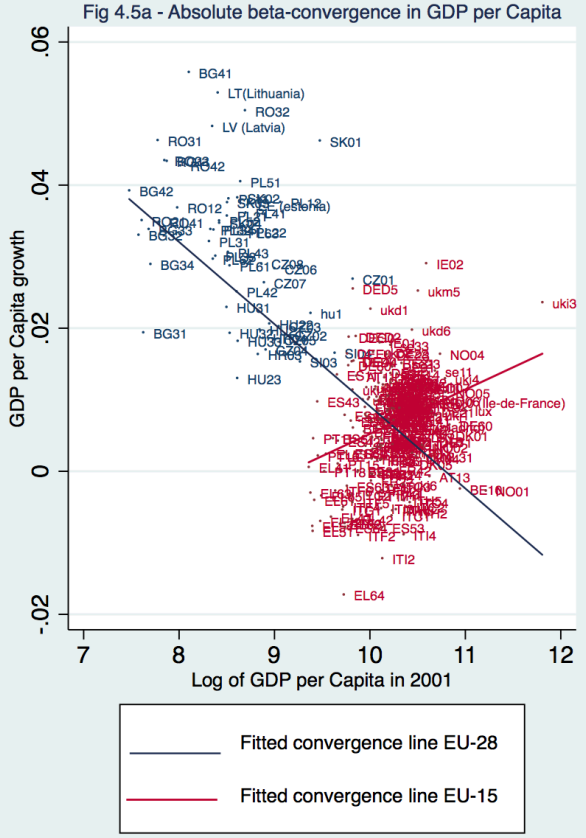


Fig 4.5b - Absolute beta-convergence in Labour productivity in Industry

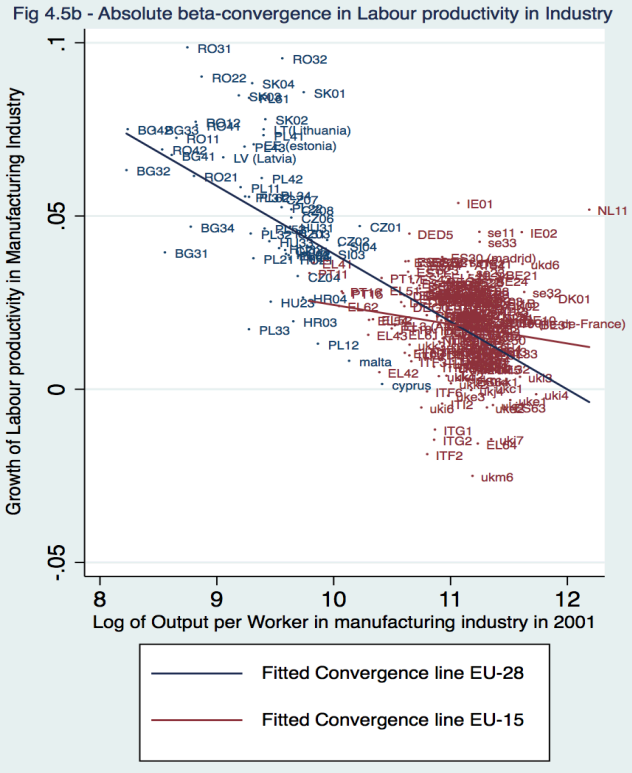
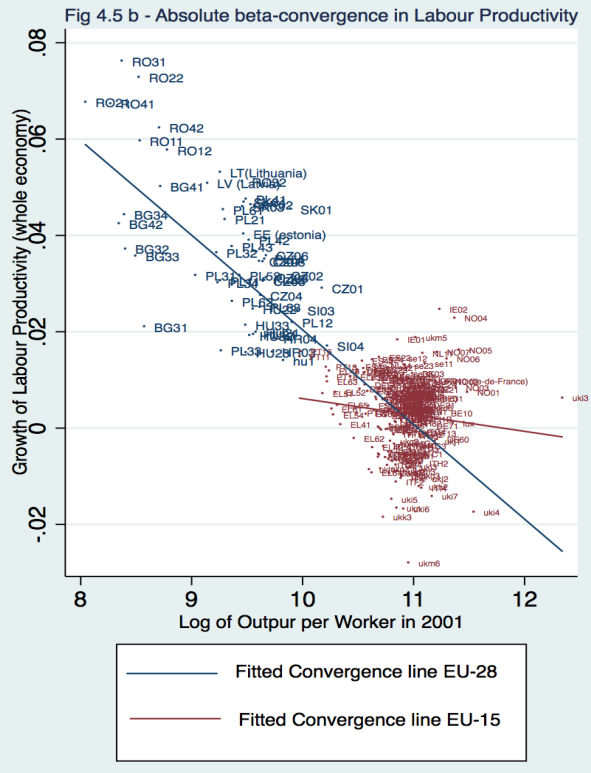


Fig 4.5 b - Absolute beta-convergence in Labour Productivity



4.7 Detecting Spatial Autocorrelation of Regional Growth

Spatial dependence between statistical observations is commonly detected with the Moran's test (Moran, 1950). The statistic reveals to what extent high (low) values of a random variable are surrounded by high (low) values of it. Therefore it evaluates whether the distribution pattern of a variable is clustered, dispersed or random (Özyurt and Dees 2015: 11).

The Moran's (I) statistics for (global) spatial auto-correlation is estimated as:

$$I = \frac{\Sigma_{i=1}^{n} \Sigma_{i}^{n} w_{j=1} W_{ij} x_i x_j}{\Sigma_{i}^{n} (x_i - u)^2} \quad (1)$$

Where n is the number of regions, x_i is the value (economic growth) observed of region *i* and region j, which is standardized or centered to the mean, and *u* is the mean of the variable x. Finally w_{ij} is the ij^{th} element of the row-standardized spatial weight matrix W (Ciotoli et al, 2016).

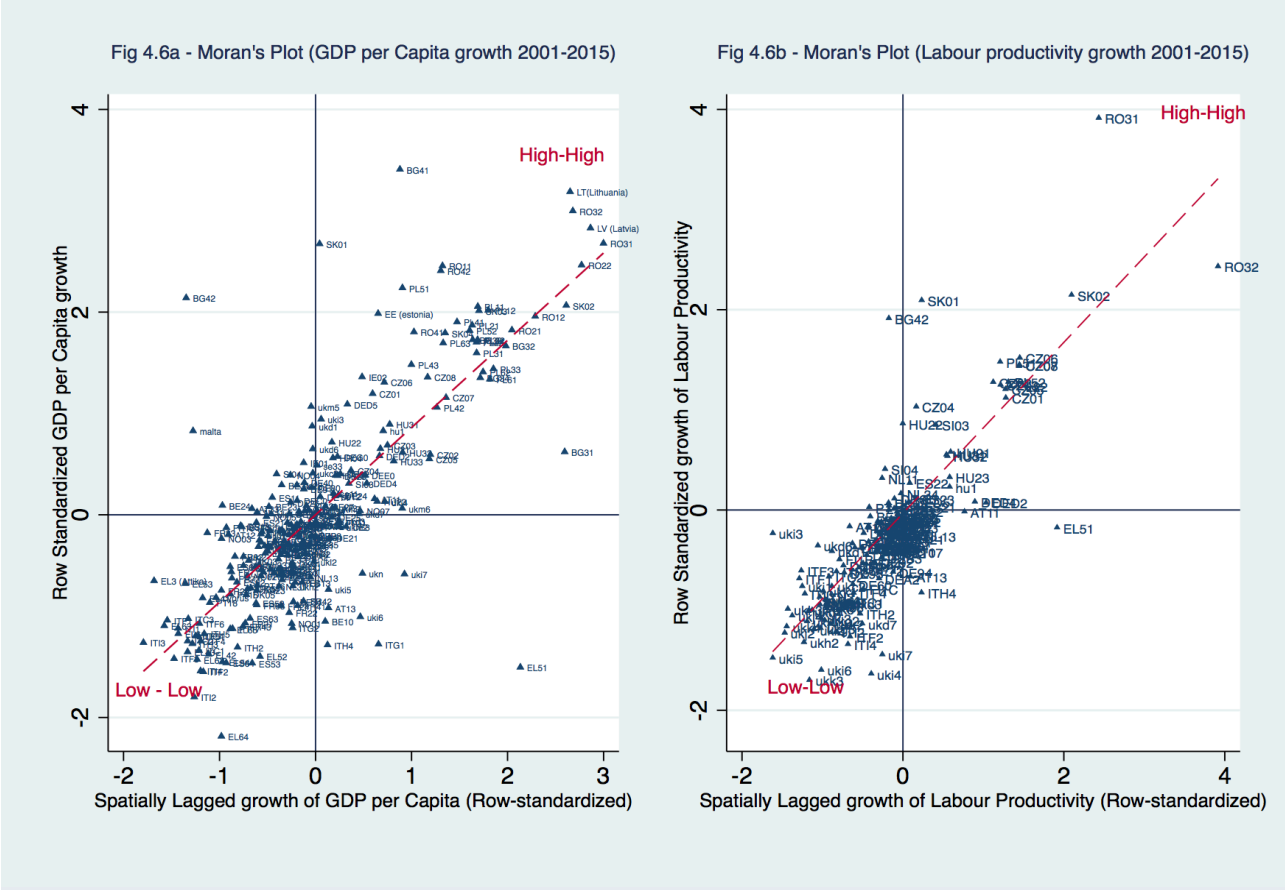
The estimations of the Moran's I (Moran's Index) for spatial autocorrelation of GDP per Capita and Labour productivity growth are reported in Table 4.3.

Table 4.3 - Moran's Index estimations

	I	E(I)	sd(I)	Z	p-value*
Variables					
GDP per capita Growth	0.67	-0.004	.016	32.6	.000
Labour Productivity Growth	0.76	-0.004	.015	36.89	.000
* One Tail Test					

The next to graph (Figure 4.6a and 4.6b) shows graphically the estimations reported in Table 4.3 of spatial autocorrelation between rates of growth (GDP per Capita and GVA per Worker) of a region and the rate of growth in the closer spatially lagged region.

The Moran's I plot displays spatially lagged standardized observations for economic growth (GDP per capita and labour productivity) plotted against the average rates of growth observed in each region during the period 2001-2015.



The first and the third quadrants (High-High and Low-Low) display the cases of positive dependence between economic growth observed in a region and economic growth observed in its neighbouring regions[34]. Symmetrically, the second and the forth quadrant display cases of negative dependence between economic growth observed in a region and economic growth observed in its neighbouring regions. Given the fact that the observations are standardized, the fitted line is the bisector of the quadrants "high-high" and "low-low and, as it possible to note, the cases of negative spatial dependence between regions are very rare if compared to the volume of the observations of positive spatial dependence.

Table 4.4 and 4.5 report directly the Moran's I statistics for spatial autocorrelation of the residuals of an OLS model of conditional regional convergence that then will be transformed in a Spatial Lag Model and in Spatial Error Model (Equation 6.2) in order to take into account the spatial autocorrelation detected with the Moran's Test.

[34] Given the fact that Cyprus has not neighbouring regions within the 1st quartile distance cutoff, the Island is excluded from the sample in the spatial regression models. Similarly, also Malta is excluded from the sample.

Table 4.4 – Moran's I Test for conditional GDP per Capita Growth and Convergence								
	Q1	P-Value	Median	P-Value	Q-3	P-Value	Q4	P-Value
Moran's I Test	6.157	0.000	4.414	.000	3.551	.000	2.761	.000

	Q1	P-Value	Median	P-Value	Q3	P-Value	Q4	P-Value
Spatial Error								
Lagrange multiplier	16.417	.000	5.267	.022	2.518	.113	1.119	.290
Robust Lagrange multiplier |	7.242	.000	3.12	.077	2.361	.124	.120	.729
Spatial Lag								
Lagrange multiplier	14.949	.000	3.163	.075	0.177	0.177	2.467	.116
Robust Lagrange multiplier	5.774	.016	1.016	.314	0.020	.887	1.469	.226

Table 4.5 – Moran's Test I for Conditional Labour Productivity Growth and Convergence								
	Q1	P-Value	Median	P-Value	Q-3	P-Value	Q4	P-Value
Moran's I Test	10.540	0.000	10.742	.000	10.704	.000	10.295	.000

	Q1	P-Value	Median	P-Value	Q3	P-Value	Q4	P-Value
Spatial Error								
Lagrange multiplier	56.861	.000	47.132	.000	42.988	.000	39.572	.000
Robust Lagrange multiplier |	21.632	.000	21.133	.000	21.250	.000	12.717	.000
Spatial Lag								
Lagrange multiplier	60.980	.000	52.339	.000	44.447	.000	51.242	.000
Robust Lagrange multiplier	25.751	.000	26.339	.000	22.708	.000	24.387	.000

As in Brasili et al (2012), the results of the Lagrange multiplier test, both for the spatial lag and the spatial error, lead to choose a spatially weighted matrix based on the 1st (Q1) quartile of cutoff distance that maximizes the value of the significant Lagrange Multiplier statistics for both GDP per capita and labour productivity growth[35].

4.8 Econometric Methodology

Given the detection of spatial autocorrelation within the sample of regions, I build a row standardized spatially lagged (inverse distance) weight matrix in order to take into account the spatial spillover in regional growth. The matrix has 272 rows and 272 columns and each off-diagonal entry [i, j] in the matrix is equal to w=1/(distance between point *i* and point *j*). Therefore the larger is the distance between points *i* and *j* (as in the matrix row we shift towards right), the smaller is the weight. Said less technically, the larger is the distance between two regions, the lower the reciprocal regional spillovers are. Therefore I define the spatial structure as an inverse

[35] Given the fact that Lagrange Multiplier specification tests indicate that both a SLM and a SEM model can be used to fit the data efficiently, I will also estimate a Spatial Autoregressive Error Model (SEM) on the same sample of NUTS territories

distance decay function, considering that the strength of spatial interaction declines with the distance (Özyurt and Dees 2015: 18). Given the presumption that the intensity of geographical spillovers decreases with distance it would be possible to interpret the results for an inverse distance matrix as a good proxy for externalities (either positive or negative) related to the variable of interest (Anselin et al, 2004).

Following the results of Moran's Test, the distance band set as cutoff applied to the Inverse Distance Weights matrix is comprised between 0 and the 1st quartile distance, meaning that regions will be considered as neighbours when located within a maximum distance equal to the 1st quartile distance. That is, growth in region *j* produces spillover effects in the region of interest *i* only when *j* is geographically located within a maximum distance equal to the 1st quartile distance cutoff.

A simple model with spatial lag dependent variable can be expressed as

$$y = \lambda W y + \varepsilon \quad (1)$$

Where y is the dependent variable and Wy is its spatial lag.

W denotes the spatial-weighting matrix W that can be expressed as (Kondo, 2016, Dukker et al, 2013):

$$W = \begin{bmatrix} 0 & w_{1,2} & w_{1,3} & \cdots & w_{1,n} \\ w_{2,1} & 0 & w_{2,3} & \cdots & w_{2,n} \\ w_{3,1} & w_{3,2} & 0 & \cdots & w_{3,n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ w_{n,1} & w_{n,2} & w_{n,3} & \cdots & 0 \end{bmatrix}$$

Where the diagonal elements take value 0 and the sum of the row takes value of 1 as the matrix is row-standardized.

Therefore,

$$y = \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ \vdots \\ y_n \end{bmatrix}, \quad \lambda \text{Wy} = \begin{bmatrix} \sum_{j=1}^{n} w_{1j} y_j \\ \sum_{j=1}^{n} w_{2j} y_j \\ \sum_{j=1}^{n} w_{3j} y_j \\ \vdots \\ \sum_{j=1}^{n} w_{n,j} y_j \end{bmatrix}, \quad \varepsilon = \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \dots \\ \varepsilon_n \end{bmatrix}$$

In the regression model the coefficient estimate λ for the matrix W can take maximum value of 1 and denotes the percentage increase in y for each percentage point increase in Wy.

Once that the matrix W has been generated, it also possible to build a model with spatially lagged predictors in the form

$$y = x + \lambda Wx + \varepsilon \quad (2)$$

The inclusion of a spatial-weighting matrix within an econometric model permits to account for Tobler's First Law of Geography according to which everything is related to everything else, but near things are more related than distant things" (Tobler 1970: 236).

4.9 Model 1: Increasing returns and Investment Rate in Manufacturing Industry

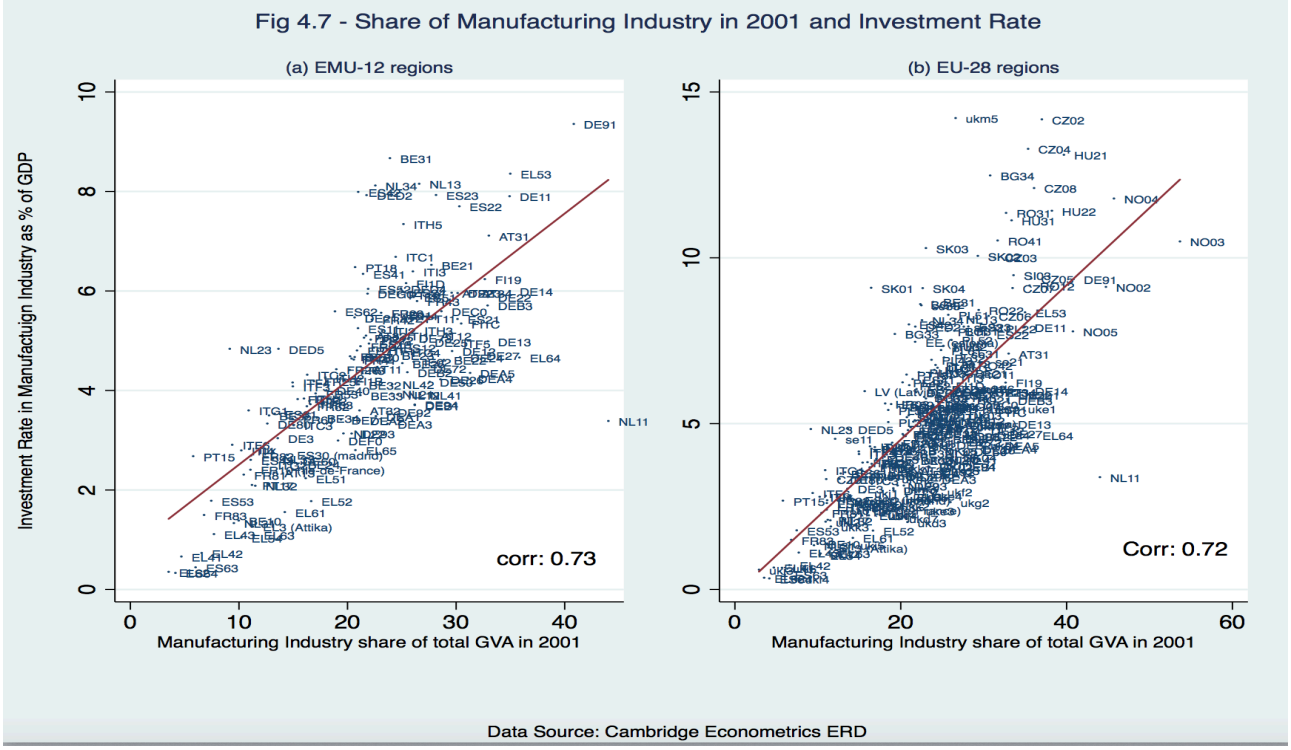
New Economic Geography (NEG) provides an integrated and micro-founded approach to spatial economics because it emphasises the role of clustering forces in generating an uneven distribution of economic activity and income across space (Venables, 2008)[36].

When economies get more integrated, firms tend to concentrate their economic activity in the geographical areas where the manufacturing sector is already large in order to minimize transport cost and benefiting from the access to a large market for intermediate production goods. Furthermore, a larger manufacturing sector also ensures a large market potential for the final goods produced by firms (Álvarez López et al, 2011; Krugman and Venables, 1990). In other words, increasing returns represent a notable incentive for firms to geographically concentrate their productive activities rather than dispersing them in several locations, due to the benefits in

[36] In Appendix 4.2 I will show the statistical maps with the economic structures of the 272 European (EU) regions

terms of production costs deriving from creating larger plants. In this respect, increasing returns crucially constitute a sort of *leitmotiv* of NEG, which is central to the explanation of the spatial differences in the distribution of productive activities (Ascani et al. 2013:3). Therefore, firms may tend to concentrate their investment activity in specific locations with an already large industrial sector when barriers to trade and international factor mobility are removed.

The process of geographical concentration of investment rate in manufacturing industry can be shown by plotting the graph of the relationship between the size of manufacturing industry in 2001 and the subsequent rates of investment in of manufacturing industry over the period 2001-2015.



As it is possible to note, the correlation coefficient between the manufacturing industry share in 2001 and the subsequent investment rate in the sector is remarkably high both in the sample of the EMU-12 regions and of the EU-28 regions.

From the econometric point of view, the process of industrial concentration that has followed the completion of the Common Market, the introduction of the Single Currency and the EU Enlargement can be modelled as follows:

$$y_i=\alpha+\rho W y_{ij}+\beta_1 X_{1,i}+\mu_i \quad (3)$$

Where y denotes the average annual investment rate in manufacturing industry as percentage to GDP during the period 2001-2015 and Wy denotes an inverse distance weight matrix of y. X_1 denotes the size of manufacturing industry in 2001.

Whether the assumption of "increasing returns and economic geography" applies for the EU regions, the ρ is expected be positive and statistically significant, meaning that investment rate in a region *i* tends to be positively related both to the investment rate in the neighbouring regions[37]. Symmetrically, also coefficient estimate β_1 on the size of manufacturing industrial sector in 2001 is expected to be positive and statistically significant, meaning that manufacturing firms had tended to invest in the regions with an already large industrial sector in order to realize scale economies.

Table 4.6: Investment Rate in Manufacturing, Initial size of Manufacturing and Spatial Spillovers

Dependent Variable: Investment Rate in manufacturing Industry (2001-2015)	Coef.
Industry Size in 2001	.3*** [.01]
Constant	-2.3*** [.38]
$\rho(Wy)$	.58*** [.12]
	Acceptance range for ρ: -1.633 < rho < 1.000

Statistically Significant at 1%
Standard Errors in Parentheses [ ]

According to the regression output, a 1% increase in the initial size of industry in 2001 is expected to be associated with an average annual 0.3% increase in investment rate in industry while a 1% increase in the investment rate in industry in a neighbouring region *j* located within the first quartile distance cutoff is expected to produce a 0.58% increase in investment rate region *i*. The model formalizes the centripetal force of economic geography in shaping regional distribution of the manufacturing industry's activity and the empirical findings essentially confirm the assumptions of the theoretical framework of NEG that focuses on increasing returns and the progressive fostering of asymmetries in the economic structures within economic and political areas when they get more and more integrated. As matter of facts, during the period 2001-2015 there was a statistically

[37] Symbol *ρ* in Equation 3 denotes the same as symbol λ in Equation 2 but with a different notation

significant tendency of investment rate in industry to concentrate within and around the regions with a larger manufacturing sector in 2001[38].

4.10 Model 2: Kaldor-Verdoorn Law

Based on Verdoorn's analysis of the Italian economy, Kaldor 's second law (1949) proves a positive relationship between growth in productivity of manufacturing industry and growth of manufacturing output. In other words, the larger is the size manufacturing industry out of the total economy, the faster the labour productivity growth in the sector.

The essential point of this proposition is the formation of scale economies because the growth of the industrial sector is characterized by increasing returns to scale and this produces growth of the output per worker in the manufacturing industry (Pons-Novell and Viladecans-Marsal, 1998).

In order to test the Kaldor's Second law in a framework of manufacturing industry agglomeration because of increasing returns, I specify the following model:

$$y_i=\alpha + \beta_1 X_{1,i} + \rho W y_{ij} + \beta_2 X_{2,i} + \beta_3 WX_{2,i} + \mu_i$$
$$(4)\ (5)$$

Where y denotes the dependent variable, annual output pre worker (4) or output per worker in industry (5) growth, during the period 2001-2015. X_1 denotes the natural logarithm of output per worker or output per worker in manufacturing industry in 2001 and Wy_{ij} denotes the inverse distance weight matrix of the dependent variable. Variable X_2 denotes the average share of manufacturing industry of total GVA in region *i*. In order to model an economy of scale I also include the variable $WX_{1,i}$ that denotes the spatially lagged size of manufacturing industry, that is, the size of manufacturing industry in region *j* located within the 1st quartile distance cutoff from region *i*.

Despite Kaldor's Second law establishes a relationship between growth in productivity of manufacturing industry and growth of manufacturing output or manufacturing size, I also estimate the relationship between overall labour productivity and the size of industrial sector because in paragraph 4.6 I showed the tight positive relationship between labour productivity growth and manufacturing industry productivity growth.

The results of the models 4 and 5 are reported in Tables 4.7 and 4.8[39].

[38] In Appendix 4.3 I will provide a short analysis about the empirical evidence that manufacturing industry activity during the period 2001-2015 tended to agglomerate in regions that had an already large manufacturing sector in 2001

Table 4.7: Convergence in Labour Productivity of Manufacturing Industry

Dependent Variable: Growth of Productivity in Manufacturing Industry (2001-2015)	
Log of Output per Worker in Manufacturing Industry in 2001	-.013***
	[.001]
Average Size of Manufacturing Industry	.0003***
	[.0001]
W*Average Size of Manufacturing Industry	.0015***
	[.0004]
Constant	.84***
	[.1]
ρ (Wy)	Acceptance range for ρ: -1.633 < rho < 1.000

Statistically Significant at 1%
Standard Errors in Parentheses

Table 4.8: Convergence in Labour productivity

Dependent Variable: Growth of Productivity	
Log of Output per Worker in 2001	-.015***
	[.001]
Average Size of Manufacturing Industry	.0002***
	[.000]
W*Average Size of Manufacturing Industry	.0008
	[.000]
Constant	.14***
	[.01]
ρ (Wy)	.77***
	[.10]
	Acceptance range for ρ: -1.633 < rho < 1.000

Statistically Significant at 1%
Standard Errors in Parentheses

The regression output is very interesting fro two reasons. First, the results confirm the fact that Kaldor's Second Law applies to process of regional development in the European Union. As matter of fact an increase in the size of manufacturing industry as percentage of total GVA is positively associated to growth of labour productivity in manufacturing industry and of overall labour productivity.

Second, coefficient estimates of the spatially lagged dependent variable (Wy) and spatially lagged size of manufacturing industry are positively associated with growth of labour productivity in manufacturing industry

[39] In Appendix 4.4 I will provide the output of the same model estimated by replacing the size of manufacturing industry with the size of market services sector

and of overall labour productivity, meaning that economic geography and scale economies paly a pivotal role in regional development. It is also worth to note the fact that there exists almost a perfect linear relationship between labour productivity in manufacturing industry in region j and labour productivity in manufacturing industry in region i, that is, in the spatially lagged regions located within the distance band comprised between 0 and the 1st quartile cutoff.

4.11 Model 3: Conditional beta-convergence and spatial spillovers

After having analysed the dynamics of industrial activity in the EU regions, in this paragraph I will present a model of conditional convergence that incorporates the inverse Distance Weights Matrix for economic growth (Harris, 2008)

In this model regional economic growth is determined by the initial conditions (based on the "Neoclassical" negative relationship between economic growth and initial GDP per Capita or Labour Productivity per Worker), by the geographical spillovers and by a vector of control variables that comprises investment rate in manufacturing industry and human capital. Whether conditional β-convergence is estimated, a possible conclusion could be the significant influence of regional spillovers on the process of convergence (Feldkircher, 2006).

Given the empirical confirmations of Kaldor's assumption in the previous paragraphs, investment rate in manufacturing industry and economic growth in neighbouring regions are expected to prove to be the main determinant of regional economic growth and conditional convergence.

The model is specified as follows[40]:

$$y_i = \alpha + \beta_1 \ln (x_{0,i}) + \rho W y_{ij} + \beta_2 x_{2,i} + \beta_3 [\psi_{3,i}] + \beta_4 [\Gamma_{4,i}] + \beta_5 D(V) + \beta_5 D(P) + \mu_i$$

(6) (7)

Where y denotes average annual rate of growth in GDP per Capita (or GVA per Worker) during the period 2001-2015 (Equation 6 and 7 respectively). W is a spatially lagged dependent variable y in the form of IDW, ρ denotes a scalar spatial regressive parameter and x_0 denotes the GDP per capita (or output per worker) in 2001.

x_0 denotes the log of GDP per Capita (6) or output per worker (7) in 2001.

The inverse distance matrix ρWy allows capture the spatial spillovers, thus how growth in a given region is influenced by growth in neighbouring regions or the spatially lagged regions[41].

[40] In Appendix 5.2 of Chapter 5 I will provide the output of the test for multicollinearity between the variables utilized in this model

X_1 denotes average investment rate in manufacturing industry while Ψ denotes a vector of control variables related to the sectorial investment rates to GDP (investment in construction, investment in agriculture investment in non-market services and investment in market services to GDP[42]).

Γ denotes a vector of control variables related to labour force (education attainment of working age population and youth occupational situation) in both the equations (6 and 7). D(V) denotes a dummy variable that takes on value 1 if the region is located within a country of the Visegrad Group (Czech Republic, Poland, Slovakia and Hungary) and 0 otherwise. D(P) denotes a dummy variable that takes on value 1 if the region is located within a country of the periphery of the EMU (Spain, Italy, Greece and Portugal) and 0 otherwise. The dummy variable is expected to show whether there exists a statistically significant tendency for regions of peripheral countries of the EMU to grow less than the other European regions. The dummy for peripheral regions can be also viewed as a strategy to incorporate "geographical location effects" in the growth equation. Furthermore, provided that geographical location affects regional economic growth, location effects are expected to have a strong impact also on growth of labour productivity.

The spatial weight matrix allows to account for "spatial" endogeneity in GDP per capita and labour productivity growth because its coefficient estimates will indicate how the economic growth (and thus an increase in demand for intermediate or final goods) or economic shocks (in case of the SEM Model) from the neighbouring regions (j's) affect economic growth in a given region *i*.

The outputs of equations 6 and 7 are reported in tables 4.8 and 4.9. Note that SLM and SEM models are estimated with Maximum Likelihood estimator. Therefore in this case there is not a coefficient of determination R^2 as in OLS regressions' output because the Maximum Likelihood estimator of the unknown parameters maximizes the probability (or likelihood) that the statistical process described by the model draws the data being actually observed. In this sense, the Maximum Likelihood coefficient estimate consists of the parameter value that denotes as the "most likely" to have produced the observed data (Stock and Watson, 2012).

Tables 4.8 and 4.9 report the outputs of Spatial Lag Model (SLM) and Spatial Lag Error (SLE) estimated with the same variables.

The results of the models are expected to confirm the empirical findings of the previous paragraphs according to which regional economic growth is mainly driven by the manufacturing industry activity and neighbourhood spillovers.

---

[41] In the regression output I will also provide the estimations of a Spatial Error Model with the same variables. In the Appendix 4.5 I will provide a brief explanation of the rationale and interpretation of Spatial Error Model

[42] Investment in market services comprises investment in wholesale, retail, transport, accommodation & food services, information and communication plus investment in financial and business services

Table 4.9: "Spatial" Conditional beta-convergence in GDP per Capita

	SLM (Spatial Lag Model) Number of obs = 272	SLE (Spatial Error Model) Number of obs = 272
Dependent Variable: GDP per Capita growth	Coefficient	Coefficient
Ln_ GDP per capita 2001	-.009***	-.0105 ***
	[.0009]	[.001[
Investment in Manufacturing	.0021***	.0019***
	[.0001]	[.0001]
Investment in Construction	.001***	.001***
	[.0002]	[.0003]
Investment in market services	.0001	.0001
	[.00008]	[.0001]
Investment in non-Market Services	-.0003*	-.0004*
	[.0001]	[.0002]
Investment in Agriculture	-.0012**	-.001
	[.0006]	[.000]
Labour force with Tertiary Education	.0003***	.0003***
	[.00007]	[.00007]
Percentage of Labour force with Primary Education or Less	-.0002*** [.00004]	-.0003*** [.000052]
Young people neither employed nor in education or training Education	-.00028*** [.0001]	-.0002* [.0001]
Periphery	-.004***	-.003**
	[.001]	[.001]
Visegrad	.0025**	.0021*
	[.0009]	[.0009]
ρ(Wy)	.35*** [.08] Acceptable range for rho: -1.633 < rho < 1.000	
λ (Wμ)		.69*** [.15] Acceptable range for lambda: -1.633 < lambda < 1.000

***Statistically Significant at 1%

**Statistically Significant at 5%

*Statistically Significant at 1%

Standard Errors in parentheses [ ]

Table 4.10:"Spatial" Conditional beta-convergence in Labour Productivity

	SLM (Spatial Lag Model) Number of obs = 272	SLE (Spatial Error Model) Number of obs = 272
Dependent Variable: Labour Productivity Growth	Coefficient	Coefficient
Log of GVA per Worker in 2001	-.0107*** [.001]	-.015*** [.001]
Investment in Manufacturing	.0024*** [.0002]	.0019*** [.0002]
Investment in Construction	.0006* [.0003]	.0007* [.0004]
Investment in market services	.0001 [.0001]	.0001 .0001
Investment in non-Market Services	.00003 [.0002]	-.00004 [.0003]
Investment in Agriculture	-.0013 [.0008]	-.0015 [.0009]
Labour force with Tertiary Education	.00017*** [.00007]	.0002** [.00009]
Percentage of Labour force with Primary Education or Less	-.00014 [.00005]	-.0000271 [.00007]
Young people neither employed nor in education or training Education	-.00025** [.0001]	-.0002 [.00016]
Periphery	-.0054*** [.002]	-.0043* [.002]
Visegrad	.0046*** [.001]	.004** [.002]
ρ(Wy)	.56*** [.07] Acceptable range for rho: -1.633 < rho < 1.000	-
λ (Wμ)		.86*** [.07] Acceptable range for lambda: -1.633 < lambda < 1.000

***Statistically Significant at 1%

**Statistically Significant at 5%

*Statistically Significant at 1%

Standard Errors in parentheses [ ]

4.13 Discussion of the Results of Models 6 and 7

The regression outputs of model 6 and 7 seem to confirm the main hypothesis described in the body of the chapter: manufacturing industry and spatial spillovers constitute the engines of regional economic growth in the European Union. On the one hand, investment rate in manufacturing industry is the sectorial investment rate with the largest positive and statistically significant coefficient estimates both for income per capita and labour productivity growth. Investment rate in other economic sectors exerts no statistically significant effects (investment in market services) or negative effects (investment in agriculture and investment in non-market services) on economic growth. Therefore manufacturing industry activity turns out to be the main determinant of regional conditional convergence in income per capita and labour productivity in the European Union.

In this framework, the fact that investment in market services produces not statistically significant effects on income and labour productivity growth is very relevant to explain lack of convergence in the EU-15 because a very large portion of the GVA in the peripheral regions of the EMU is produced by the market services sector as shown in the statistical maps in Appendix 4.2.

On the other hand, statistically significant coefficients estimates for ρ and λ confirm the spatial autocorrelation of the Moran's Index as reported in table 4.3. From technical point of view, the fact that coefficients estimates ρ and λ are larger for Labour Productivity growth than for GDP per capita growth in perfect coherence with the Moran's Index estimated and reported in table 4.3, confirms the robustness of the econometric approach and analysis.

Furthermore, the empirical evidence that spatial autocorrelation for labour productivity growth is larger than spatial autocorrelation for GDP per Capita growth confirms the hypothesis of increasing returns as stated in the *New Economic Geography* theoretical framework. Indeed in the short run regions may experience demand-led economic growth as in the case of the occurrence of a housing bubble or increase in government consumption that may temporarily boost jobs creation, regardless of neighbourhood spillover and spatial location.

Instead, long run economic growth can be sustained only when it is underpinned by growth in labour productivity that, according to the model, in turns strictly depends on investment rate in industry, increasing returns and spatial spillovers. As Krugman (2004) remarks, a country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker.

At the same time the positive and statistically significant coefficient estimate for λ (spatially lagged error) tell us that the passthrough of regional spillover make growth in a given region also very sensitive to macroeconomic or productivity shocks (either positive or negative) taking place in the neighbouring regions.

Another relevant empirical evidence is represented by the statistical significance of the dummy or binomial variable utilized to denote regions belonging to the peripheral countries. Indeed the negative coefficient estimate confirms that economic growth Southern European regions is also conditioned by "location effect", that is by the fact that regions are located within a peripheral country, be it Spain, Greece, Portugal or Italy. This essentially means that on average growth in income per capita and labour productivity tend to be lower than in the other European regions.

Symmetrically also positive and statistically significant coefficient estimate for the binomial variable denoting regions located within the Visegrad Group confirm the relevance of the "location effect" for regional economic performances. This essentially means that growth in income per capita and labour productivity in the regions of the Visegrad Group tend to be higher than in the other European regions.

Location and spatial effects excluded, the coefficients estimates for the other control variables confirm the common findings in the growth literature. A skilled labour force has a positive impact of economic growth while unskilled labour force has a negative impact. At the same time, human capital deterioration (proxied as the percentage of young "NEET" population on the total young population) has always a negative impact on regional economic performances.

4.14 Conclusions

The empirical evidence arising from the combination of the *New Economic Geography* theory and *Kaldorian* assumptions leads to some important conclusions with relevant policy implications.

In paragraph 4.9 and 4.10 I have showed that since the early 2000s the process of European economic integration has been characterised by a progressive tendency of manufacturing firms to concentrate their investments within or around the regions with already large industrial sector.

Therefore reciprocal regional spillovers have fostered the emergence of a group of regions located in mainly in those regions of Germany, Austria (and partially Finland and the Netherlands) and in the Visegrad group with a strong manufacturing vocation.

Such concentration of investment rate of manufacturing firms in the core regions and the neighbouring ones led to an expansion of the manufacturing industry the has favoured the emergence of scale economies that in turn drove high rates of growth in labour productivity and GDP per capita. As matter of facts in Table 4.2, I showed that regional convergence (in GDP per Capita and labour productivity) in the EU-28 was driven by the regions of Eastern Europe, which actually experienced convergence in manufacturing industry labour productivity.

Conversely in the EMU-12 and EU15, where no convergence in manufacturing industry productivity took place, regional divergence in GDP per Capita and overall labour productivity was observed.

High rates of growth and convergence in labour productivity in manufacturing industry, overall labour productivity and GDP per Capita have been triggered by a virtuous circle of investment rate in industry, the growth of manufacturing sector as share of total GVA and regional spillovers. Symmetrically, negligible convergence or divergence in regions of Southern Europe have been triggered by a vicious circle represented by the progressive shift of manufacturing industry activity towards the regions of Northern and Central Europe.

This bifurcation in regional convergence perfectly matches the process of the bifurcation in "between countries" convergence highlight in Paragraph 1.6 of Chapter 1.

Finally in Paragraph 4.11 I estimated a conditional convergence model of labour productivity and GDP per Capita of the 272 regions located in the EU-28. The model that incorporates an inverse distance weight matrix shows both that investment rate in manufacturing industry is the main "discretional" determinant of regional growth while geographical spillovers produce self-reinforcing virtuous cycles of economic growth. I use the term discretional to indicate the fact that the geographical location that is an "immutable" characteristics out of policy discretion).

Therefore in a framework a progressive reduction of the government intervention in the economy, the observed tendency of productive specialization and asymmetric regional development it is likely to foster regional disparities in the levels of economic development across European regions. As the output of models 6 and 7 shows (tables 4.9 and 4.10), regional convergence in GDP per capita and overall labour productivity is conditional on a set of exogenous variables including investment rate in industry that tends to be higher in regions where the size of manufacturing sector is larger. At the same time economic growth and convergence in a given region is strictly associated with economic growth in the neighbouring regions, which in turn is positively affected by investment rate in industry and the size of industrial sector in the neighbouring regions as well.

In this framework, the progressive structural shift from manufacturing to service sector has several log-run implication for regional economic growth. First, if a large part of the workforce moves into the service sector, productivity growth within services will probably determine the outlook for living standards overall. However a large part of service sectors such as wholesale, retail, accommodation and food services is less or no amenable to technological progress, therefore less capable to generate wealth if compared to the manufacturing sector. As a

consequence in many countries and regions the long-term average rate of growth will be determined by the activity in which productivity growth is slowest (Rowthorn and Ramaswamy, 1997).

For example Accetturo et al (2015) argue that the stagnation of income per capita in North-West of Italy since the end of the 1990s is mainly due to a process of deindustrialization and tertiarization of the economy and to a too slow structural transition towards high-intensity technology and knowledge-intensive services sectors.

In such a framework it is very likely that regional disparities within the European Union are bound to become increasingly relevant with the emergence of a European "core" growing fast, a group of integrated regions (Visegrad regions) converging, and a group of peripheral regions (Italian *Mezzogiorno*, South of Spain, Portugal and Greece) lagging persistently behind the core regions. As matter of facts the geographical location effects captured with the dummy variable for regions located in the periphery of the EMU, besides producing negative and statistically significant effects on GDP per capita growth, produce also stronger negative and statistically significant effects on labour productivity growth. The evidence of negative location effects in the peripheral regions of the EMU for labour productivity growth in particular can be interpreted as the difficulty common to the peripheral regions to get more integrated in the core regions industrial value chain and to develop scale economies and competitiveness.

As matter of facts also Farole et al (2018:9) argue in a Report from the World Bank that if the trends of the past decade were to continue, by 2025 the poorest regions of Romania, Poland, Hungary, and Bulgaria will be richer, on average, than the lagging regions of Italy, Spain, Portugal, and Greece.

4.14 Policy Implications

Manufacturing industry is also commonly recognized as the main driver of innovation and technological advancements (Coad and Vezzani, 2017), therefore the uneven regional distribution of the industrial activity may further exacerbate divergence by determining also to the emergence of a group of regions lagging chronically behind the core regions in technology and innovation. As Porter (2009:263) remarks, industrial cluster participation offers to the firms the advantages in perceiving new technological, operational and delivery possibilities. Participants learn early and consistently about evolving technology, component and machinery availability and service availability facilitated by on-going business interactions and relationships with other firms within the same industrial clusters. As Ciccone (2001) remarks, despite education and public infrastructure matters, large differences in regional productivity in Europe and the United State are mainly driven by agglomeration effects in the manufacturing sector that allows larger economies of scale and

technological transfer and the emergence of a larger variety of service firms that further enhance labour productivity in the regions.

Therefore this perspective has lead many economists to formulate proposals for a new "European" industrial policy based on innovation and investment in knowledge-intensive industrial sectors. For example Mazuccato (2018) points out that weak economic performances in Southern Europe in the last 20 years are attributable to low level of government investment in the strategic sectors of innovation and productivity. Fiscal austerity in the periphery has further contributed to the European duality between Northern and Southern Europe in R&D expenditures.

In order to address this "European" challenge Myro (2019:11) proposes the set up of specialised European agencies with the function to coordinate a new industrial policy aimed at the development of new technologies and help define new activities and products, by creating an extensive network of cooperation between all agents involved; public administration, business, trade unions and consumers.

Appendix 4.1: Table of Regions with NUTS code and Name

Table 4.1.1 - Appendix A - Nomenclature of NUTS-1 and NUTS-2 territorial units in the Sample

Code	Region	Code	Region	Code	Region
AT11	Niederösterreich	FR26	Bourgogne	SE32	Västernorrlands
AT12	Wien	FR30	Nord-Pas-de-Calais	SE33	Övre Norrland
AT13	Kärnten	FR41	Lorraine	NO01	Oslo og Akershus
AT21	Steiermark	FR42	Alsace	NO02	Hedmark og Oppl.
AT22	Steiermark	FR43	Franche-Comté	NO03	Sør-Østlandet
AT31	Oberösterreich	FR51	Pays de Loire	NO04	Agder og Rogaland
AT32	Salzburg	FR52	Bretagne	NO05	Vestlandet
AT33	Tirol	FR53	Poitou-Charentes	NO06	Trøndelag
AT34	Vorarlberg	FR61	Aquitaine	NO07	Nord-Norge
BE10	Région de Bruxelles	FR62	Midi-Pyrénées	HR03	Jadranska Hrvat.
BE21	Antwerpen	FR63	Limousine	HR04	Kontinentalna Hrv.
BE22	Limburg (B)	FR71	Rhône-Alpes	UKC1	Tees Valley e Dur.
BE23	Oost-Vlaanderen	FR72	Auvergne	UKC2	North. & Ty. & W.
BE24	Vlaams Brabant	FR81	Languedoc-Rouss.	UKD1	Cumbria
BE25	West-Vlaanderen	FR82	Prov.-A.-Côt. d'Az.	UKD3	Grea. Manchester
BE31	Brabant Wallon	FR83	Corse	UKD4	Lancashire
BE33	Liège	IE01	Southern and East.	UKD6	Cheshire
BE34	Luxembourg (B)	IE02	Boar, Midla. & W.	UKD7	Merseyside
BE35	Namur	ITC1	Piemonte	UKE1	East Rid. & No. Lin.
BG31	Severozapaden	ITC2	Valle d'Aosta	UKE2	North Yorkshire
BG32	Severen tsentralen	ITC3	Liguaria	UKE3	South Yorkshire
BG33	Severoiztochen	ITC4	Lombardia	UKE4	West Yorkshire
BG34	Yugoiztochen	ITF1	Abruzzo	UKF1	Derbyshire & Nott.
BG41	Yugozapaden	ITF2	Molise	UKF2	Leic.,Rut. & North.
BG41	Yuzhen tsentralen	ITF3	Campania	UKF3	Lincolnshire
CZ01	Praha	ITF4	Puglia	UKG1	Her.,Wor. & Warw.
CZ02	Střední Cechy	ITF5	Basilicata	UKG2	Shrops. e Staffords.
CZ03	Jihozápad	ITF6	Calabria	UKG3	West Midlands
CZ04	Severozápad	ITG1	Sicilia	UKH1	East Anglia
CZ05	Severovýchod	ITG2	Sardegna	UKH2	Bedford.&Hertford
CZ06	Jihovýchod	ITH1	Trentino	UKH3	Essex
CZ07	Střední Morava	ITH2	Alto Adige	UKI4	Inner London
CZ08	Moravskoslezsko	ITH3	Friuli Venezia-Giu.	UKI5	Outer London
DK01	Hovedstaden	ITH4	Veneto	UKI6	Inner London
DK02	Sjælland	ITH5	Emilia-Romagna	UKI7	Outer London
DK03	Syddanmark	IT11	Toscana	UKJ1	Berk, Buck.,& Oxfo.
DK04	Midtjylland	ITI2	Umbria	UKJ2	Surr.,Ea. & We. Su.
DK05	Nordjylland	ITI3	Marche	UKJ3	Hamp. & Is. of Wig.
DE11	Stuttgart	ITI4	Lazio	UKJ4	Kent
DE12	Karlsruhe	HU1	Közép-Mag. (Bud.)	UKK1	Glo., Wil. & Br/Bat.
DE13	Freiburg	HU21	Közép-Dunántúl	UKK2	Dorset & Somerset
DE14	Tübingen	HU22	Nyugat-Dunántúl	UKK3	Corn. & Scilly Isl.
DE21	Oberbayern	HU23	Dél- Dunántúl	UKK4	Devon
De22	Niederbayern	HU31	Észak-Magyar.	UKL1	West Wales & Vall.
DE23	Oberpfalz	HU32	Észak-Alföld	UKL2	East Wales
DE24	Oberfranken	HU33	Dél-Alföld	UKm2	Eastern Scotland
DE25	Mittelfranken	NL11	Groningen	UKm3	South Wes. Scot.
DE26	Unterfranken	NL12	Friesland	UKm5	North East. Scot.
DE27	Schwaben	NL13	Drenthe	UKm6	Highl. & Islands
DE30	Berlin	NL21	Overijssel	UKN1	Northern Ireland
DE40	Brandenburg	NL22	Gelderland		
DE50	Bremen	NL23	Flevoland		
D£60	Hamburg	NL31	Utrecht		
DE71	Darmstadt	NL32	North Holland		
DE72	Gießen	NL33	South Holland		
DE73	Kassel	NL34	Zeeland		
DE80	Meck.-Vorp.	NL41	North Brabant		
DE91	Braunschweig	NL42	Limburg		
DE92	Hannover	PL11	Łódzkie		
DE93	Lüneburg	PL12	Mazowieckie (W.)		
DE94	Weser-Ems	PL21	Małopolskie		
DEA1	Düsseldorf	PL22	Śląskie		
DEA2	Koln	PL31	Lubelskie		
DEA3	Münster	PL32	Podkarpackie		
DEA4	Detmold	PL33	Świętokrzyskie		
DEA5	Arnsberg	PL34	Podlaskie		
DEB1	Koblenz	PL41	Wielkopolskie		
DEB2	Trier	PL42	Zachodniopomorskie		
DEB3	Rheinhessen-Pfalz	PL43	Lubuskie		

DEC	Saarland	PL51	Dolnośląskie
DED1	Chemnitz	PL52	Opolskie
DED2	Dresden	PL61	Kujawsko-Pomor.
DED3	Leipzig	PL62	Warmińsko-Mazur.
DEE	Sachsen-Anhalt	PL63	Pomorskie
DEF	Schleswig-Holstein	PT11	Norte
DEG	Thuringia	PT15	Algarve
EL3	Attica	PT16	Centro
EL41	North Aegean	PT17	Area Met. Lisboa
EL42	South Aegean	PT18	Alentejo
EL43	Crete	RO11	Nord-Vest
EL51	East. Mac. & Thr.	RO12	Centru
EL52	Central Macedonia	RO21	Nord-Est
EL53	West. Macedonia	RO22	Sud-Est
EL54	Epirus	RO31	Sud-Muntenia
ES11	Galicia	RO31	Bucarest
ES12	Principado de As.	RO41	Sud-Vest Oltenia
ES13	Cantabria	RO41	Vest
ES21	País Vasco	SI03	Vzhodna Slovenija
ES22	Navarra	SI03	Zahodna Slovenija
ES23	La Rioja	SK01	Bratislava Region
ES24	Aragon	SK02	Západné Slovensko
ES30	Com. De Madrid	SK03	Stredné Slovensko
ES41	Castilla – León	SK04	Východné Slovensko
ES42	Castilla-La Mancha	FI19	West Finland
ES43	Estremadura	FI1B	Helsinki-Uusimaa
ES51	Catalunya	FI1C	South Finland
ES52	Co,. Valenciana	FI1D	North & East Finland
ES53	Islas Balearias	ET0	Estonia
ES61	Andalucia	LV0	Latvia
ES62	Región de Murcia	LT0	Lithuania
ES63	Ceuta	LUX0	Luxembourg
ES64	Malilla	SE11	Stockholmd
FR21	Champagna-Ard.	SE12	Östra Mellansverige
FR22	Picardie	SE21	Småland medöarna
FR23	Haure-Norman.	SE22	Sydsverige
FR24	Centre	SE23	Västsverige
FR25	Basse Norman.	SE31	Norra Mellansverige
	.		

Appendix 4.2: Regional Economic Structures

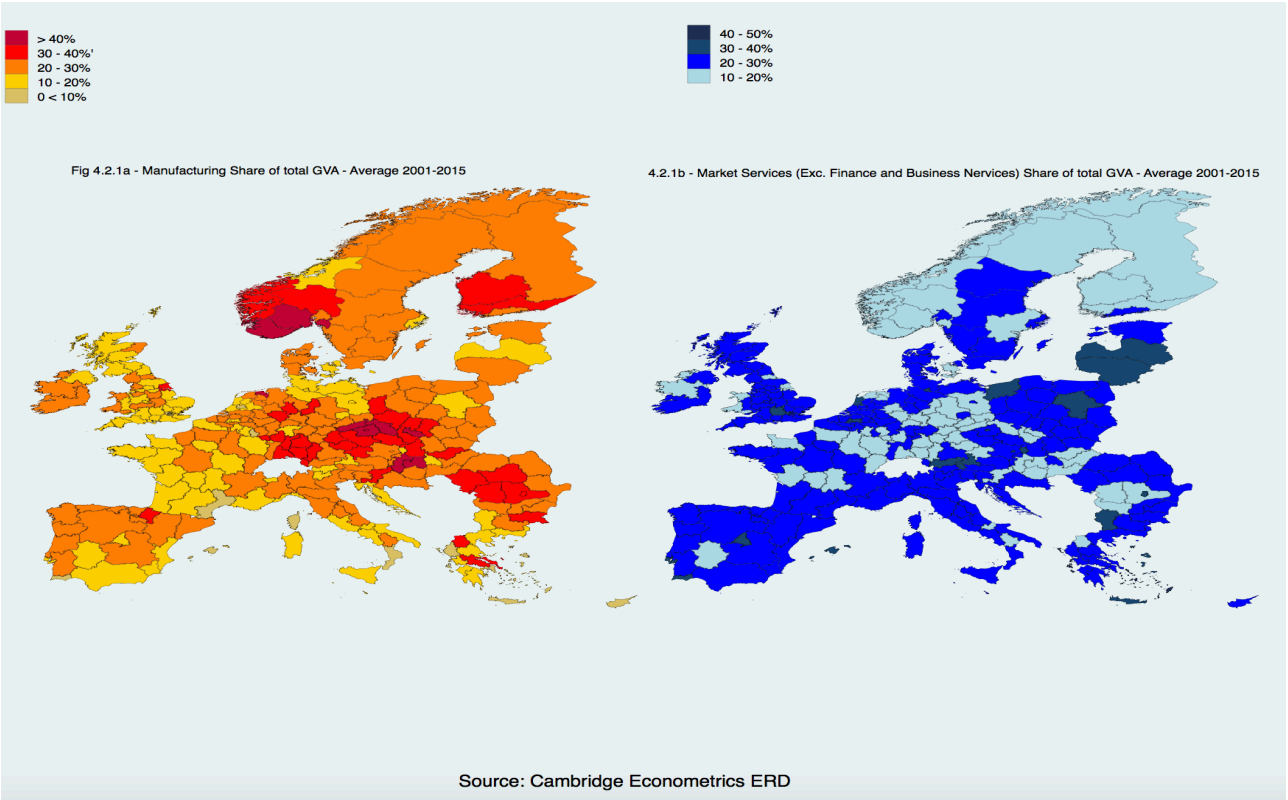


Fig 4.2.1a - Manufacturing Share of total GVA - Average 2001-2015

4.2.1b - Market Services (Exc. Finance and Business Nervices) Share of total GVA - Average 2001-2015

Source: Cambridge Econometrics ERD

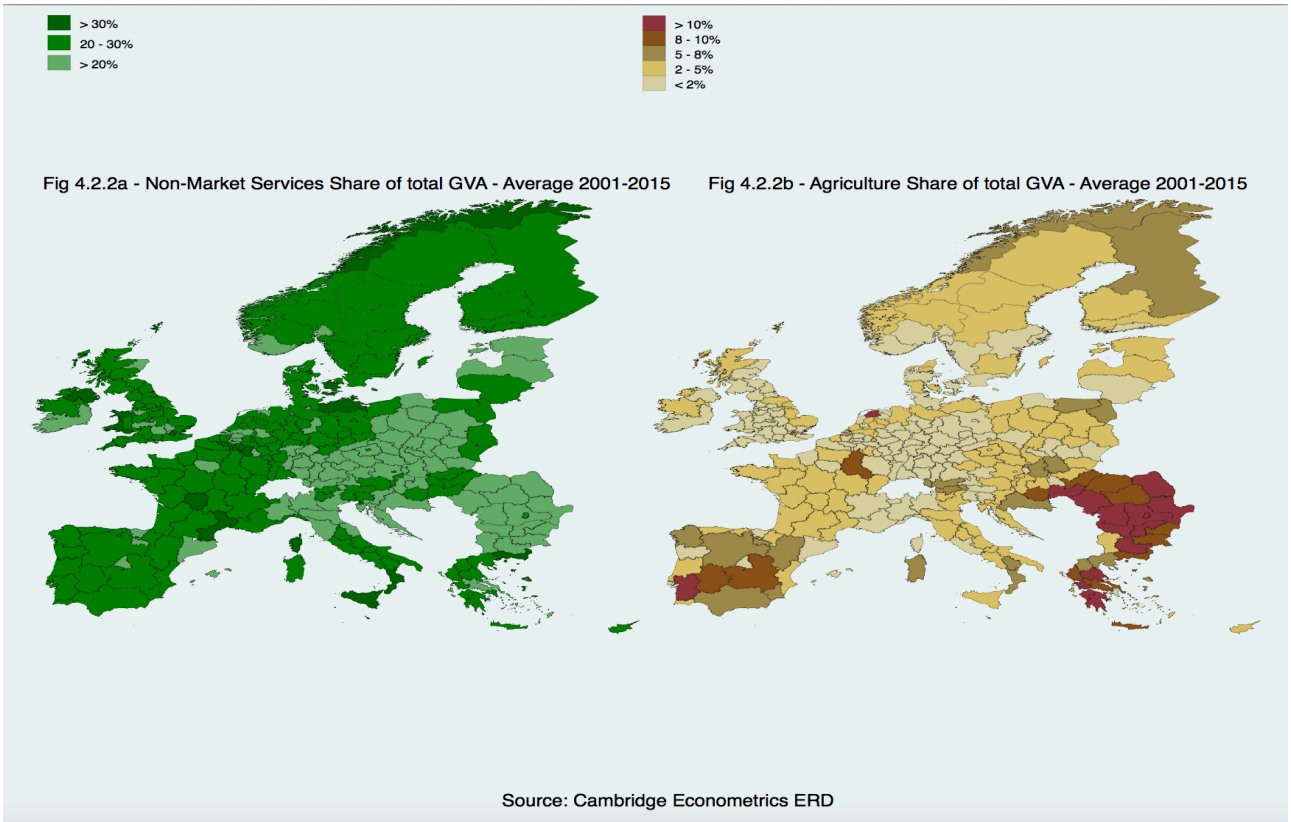


Fig 4.2.2a - Non-Market Services Share of total GVA - Average 2001-2015

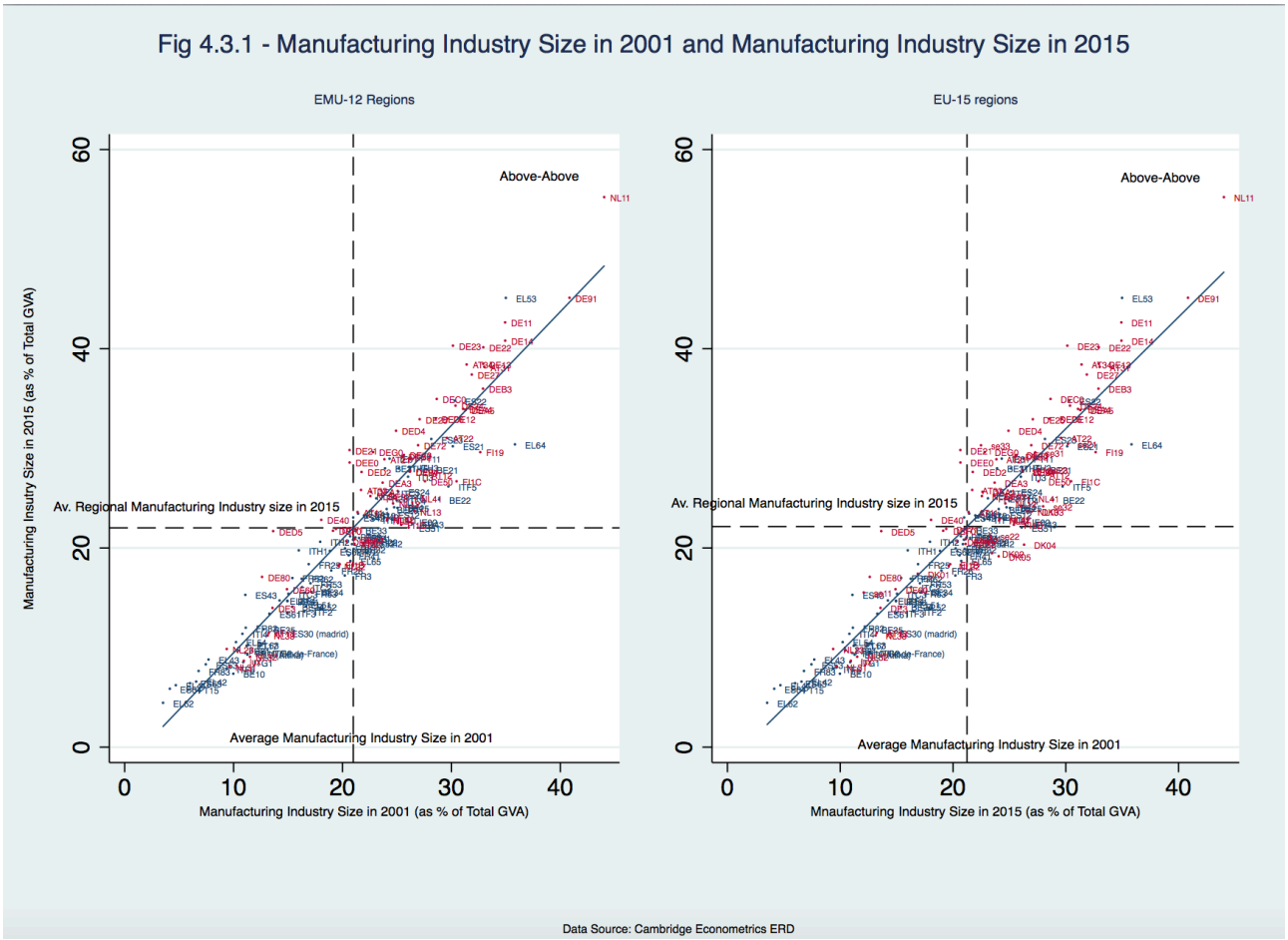
Fig 4.2.2b - Agriculture Share of total GVA - Average 2001-2015

Source: Cambridge Econometrics ERD

Appendix 4.3: Regional De-location and Relocation of Manufacturing Activity across the EU

In paragraph 4.9 I show the tight positive relationship between the size of manufacturing industry in 2001 and the subsequent investment rate in manufacturing industry during the period 2001-2015 observed in the European regions. This empirical evidence essentially confirms the intuitions of New Economic Geography about the role of scale economies, increasing return and larger demand in shaping asymmetries in regional economic structure. As Krugman (1993:242) remarks, although most economists believe that international trade and factor mobility promote convergence in factor prices and economic structure, the evidence and the theory suggest that the contrary is the case: a more integrated market leads to divergence in both the economic structures and the rate of growth of regions. Therefore the tendency of investment rate in manufacturing industry to concentrate in the regions with larger industrial sectors since the early 2000's, it is likely to have exacerbated the divergence in regional economic structures.

Figure 4.3.1 shows the relationship between the size of manufacturing industry in 2001 and the size of manufacturing industry in 2015 both in the EMU-12 and EU-15 regions.

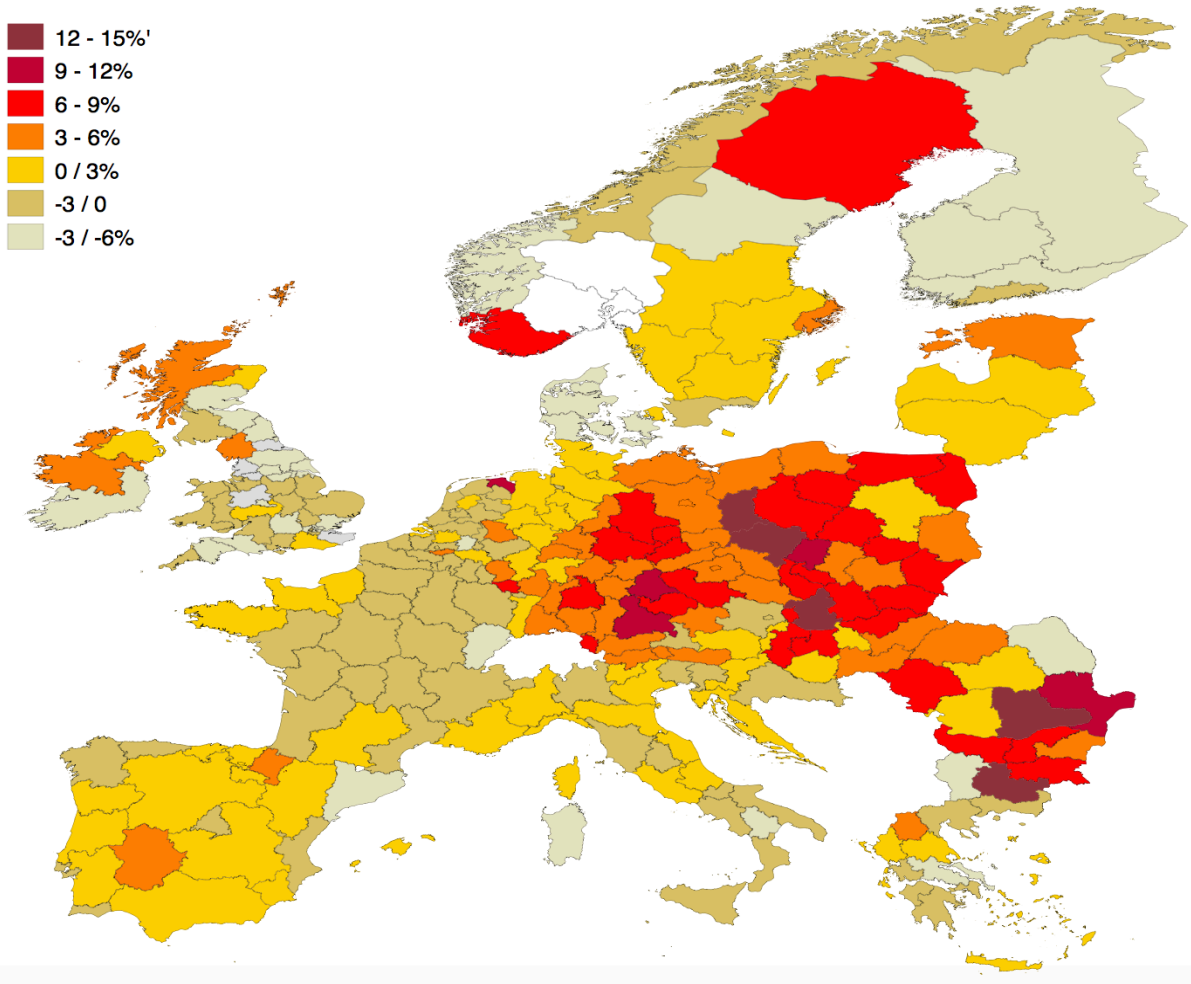


In Figure 4.3.1 the vertical dashed line indicates the average regional manufacturing size in 2001 and the horizontal dashed line indicates the average regional manufacturing size in 2015 (as percentage of total GVA). Most of the regions with a manufacturing industry GVA in 2001 above the EMU-12 and EU-15 regional average are actually the regions with a manufacturing industry GVA above the EMU-12 and the EU-15 regional average in 2015. With few exceptions, these regions (red labelled) are located in the Northern European countries, mainly in Germany, Netherlands, Finland and Austria (in the EMU-12) plus Denmark and Sweden if the regions of remaining "Western" member states are included in the graph.

As it is possible there is a perfect positive linear relationship between the size of manufacturing industry in 2001 and the size of manufacturing industry in 2015.

Figure 4.3.2 makes the things clearer by showing the statistical map of the cumulative change in manufacturing industry size occurred in the European regions during the period 2001-2015.

Fig 4.3.2 - Total change in the size of Manufacturing Industry /as % of Total GVA



Dara Source: Cambridge Econometrics ERD

As it is possible to note, growth of manufacturing sector tended to concentrate in Germany, Austria and the surrounding regions.

Most of regions where the manufacturing industrial sector shrank compared to the 2001 levels are located in France, Greece and South of Italy (and the UK). "Successful" Spanish and Italian regions recorded an expansion of the manufacturing industrial sector generally below the levels observed in most of German regions Germany, Austria and in the Visegrad group.

In order to quantify the relationship between the size of manufacturing industry in 2001 and its size in 2015, I estimate the following univariate OLS simple regression model:

$$\textit{Industry Size in 2015}_i = \text{Constant} + \textit{Industry Size in 2001}_i + \textit{Error Term}$$

Table 4.3.1

Dependent Variable: *Industry Size in 2015*	EMU-12	EU-15
Industry Size in 2001	1.14***	1.12***
	[.03]	[.03]
Constant	-1.93***	-1.67**
	[.68]	[.71]
R2	.89	.88

***Statistically Significant at 1%
Standard Errors in Parentheses [ ]

Besides the perfect positive linear relationship between the regional size of manufacturing observed in 2001 and in 2015, the regression output also shows that the regional size of manufacturing industry observed in 2001 explains 89% of the cross regional variation in the size of manufacturing industry observed in 2015.

This empirical evidence in Europe further confirms both the analysis the fact that economic integration and mobility of factors of production may lead to divergence in economic structures and rates of growth of the regions as envisaged by Krugman (1993).

Appendix 4.4: Neighbourhood Spillovers in Labour Productivity and Size of Market Services Sector

In order to test the relevance of economic structure in the framework of New Economic Geography, I specify the following model:

$$y_i=\alpha + \beta_1 X_{1,i} + \rho W y_{ij} + \beta_2 X_{2,i} + \beta_3 WX_{2,i} \mu_i$$

(1) (2)

Where y denotes the dependent variable, annual output pre worker (1) or output per worker in industry (2) growth, during the period 2001-2015. X_1 denotes the natural logarithm of output per worker or output per worker in manufacturing industry and Wy_{ij} denotes the inverse distance weight matrix of the dependent variable. Variable X_2 denotes the average share of market services sector of total GVA in region *i*. and in region *j* located within the 1st quartile distance cutoff from region *i* and *W*X denotes the size of market services sector in the neighbouring region j located within the 1st quartile distance band.

Table 4.3.1

Dependent Variable: Growth of Labour Productivity in Manufacturing Industry	
Log of Output per Worker in Manufacturing Industry in 2001	-.011***
	[.001]
Average Size of Market Services sector	. .0001
	[.0001]
W* Average Size of Market Services sector	-.002***
	[.0006]
Constant	
	.19***
	[.02]
ρ (Wy)	.70***
	[.08]
	Acceptance range for ρ: -1.633 < rho < 1.000

Statistically Significant at 1%
Standard Errors in Parentheses

Table 4.3.2

Dependent Variable: Growth of overall Labour Productivity	
Log of Output per Worker in 2001	-.013***
	[.001]
Average Size of Market Services sector	.0001
	[.0001]
W* Average Size of Market Services sector	-.0019***
	[.0004]
Constant	.18***
	[.01]
ρ (Wy)	.57***
	[.07]
	Acceptance range for ρ: -1.633 < rho < 1.000

Statistically Significant at 1%
Standard Errors in Parentheses

The output of the models is remarkably interesting because indirectly confirms the assumptions of both New Economic Geography theoretical framework and of the Kaldor's laws.

As it is possible to note, the size of market services sector produces no effect on labour productivity growth while the size of market services sector in the neighbouring regions j's has an adverse impact on productivity growth in region *i*. At the same time there exists a strong spatial autocorrelation between growth in labour productivity in region *i* and growth in labour productivity in region *j* located within the 1st Quartile distance cutoff. This evidence essentially means that labour productivity growth both in the whole economy and in manufacturing industry tends to be lower in those regions that specialize in the market services sector. As matter of facts, small size of manufacturing industry and large size of market service sector as share of GVA in a specific region and in neighbouring regions as well, is likely to reduce firms' ability to achieve scale economies through inter-industry trade for intermediate goods.

Appendix 4.5: Spatially Lagged Error Model

The Spatial Error Model has an error term that takes on the form $\mu = \lambda Wu + e$ and it consists of including in the regression an additional term of lagged error or fluctuation u.

Here the spatial correlation structure of the error term determines parameter λ that denotes the intensity of correlation of fluctuation in economic growth (Acevedo, 2013). Therefore parameter λ identifies the intensity with which economic shocks are transmitted from a region to another, in this case within the first quartile distance cutoff. In the case of spatial error model, rather than being directly affected by the growth rate of its neighbours, a region's growth rate is supposed to be influenced by a complex set of random, unexpected shocks transmitted across space (Curran, 2009). The model assumes the incidence of global spillovers in unobservable variables or disturbances, meaning that the structure of the residuals is determined by a spatial autoregressive process. As Millo and Piras (2012) remark, fluctuations in economic activity across regions result from a wide variety of aggregate and disaggregate phenomena that reflect underlying changes in innovations (positive shocks), crisis (negative shocks) or changes in regulations.

Chapter 5

An Institutional Analysis of Regional performances in the EU-15

5.1 Introduction

The period 2001-2015 was characterized by very poor regional economic performances in the old Member states European Union (EU-15). However, despite the financial crisis and the consequent double dip recession analysed in Chapter 3, some regions performed much better than others while a group of 44 regions recorded negative rates of average economic growth. The worst economic performances were generally observed in the Italian and Greek regions that are also the region with the weakest quality of government institutions. The role of government institutions in the process of regional development and convergence in Europe is stressed also in a Report of the World Bank (Farole et al, 2018) in which the authors argue that these regions are lagging also because the weak quality of regional government institutions.

Therefore, in this chapter that concludes the dissertation I propose an analysis of the regional performances in Europe from a different theoretical and methodological perspective[43]. Based on an extensive body of literature I will test the hypothesis that besides economic geography, economic structures and government fiscal policy also the quality of government institutions matters for regional economic development. As a consequence this chapter can be seen as a "complementary" section of this dissertation that analyses the determinant of growth and convergence across countries and regions in the EU after the introduction of the Single Currency.

This chapter aims at contributing to the existing literature by modelling the relationship between regional economic performances and the quality of institutions with an econometric approach based on binary response models for estimating marginal probability that a certain economic performance will take shape or not in a region conditional on the quality of institutions and other control variables commonly used in the analysis of economic growth. Therefore, with this approach I quantify the extent to which the quality of government institutions has shaped regional economic performances in the "old" European Union throughout the period comprising the Great Recession and empirical results show that: 1) The higher is the quality of institutions, the higher is the probability that a region with high income per capita will grow above the levels of European Union as a whole; 2) The higher is the quality of institutions, the lower is the probability that a low income region will grow below the levels of European Union as a whole; 3) The higher in the quality of institutions, the higher is the probability that any region, regardless of its income per capita, will outperform the European Union as a whole/ the lower is the probability that any region, regardless of its income per capita, will underperform the European Union as a whole; 4) The higher is the quality of Institutions, the lower is the probability that a region will "fail" to grow.

[43] From this chapter I have extracted a paper that has been published by the European Journal of Government and Economics (2019, Volume 8, N. 2) and it is available for download at the link http://revistas.udc.es/index.php/ejge/issue/view/ejge.2019.8.2

5.2 Literature Review

Neoclassical Growth Model and its empirical extensions for growth analysis have traditionally focused on exogenous factors such as saving rate, population growth and technological progress (Solow, 1956). Within the stream of the neoclassical approach, Mankiw et al (1992) have also remarked the relevant role played by human capital in the transitional dynamics to the steady state output per worker. Other streams of theoretical and empirical literature about economic growth have focused on human capital and endogenous technological change arguing that innovation is the engine of economic growth and it is endogenously generated (Romer, 1986; Lucas, 1988).

The consequence of the fact that human capital accumulation is not subjected to decreasing returns as physical capital does can explain the discontinuity or the slow speeds of convergence often observed within groups of regions or countries (Martin and Sunley, 1998).

By including variables that can broadly be considered as proxies for institutional quality in a cross section of 98 countries, Barro (1991) finds out that economic growth is positively related to measures of political stability and negative related to the market distortions induced in the economy by the political sphere.

Also in a panel of around 100 countries with data collected from 1960 to 1990, Barro (1996) finds out that for a given level of initial GDP per Capita, the growth rate is enhanced among others also by a better maintenance of the rule of law. However, the lack of institutional content in the core Neoclassical Theory has become an issue both on a theoretical level, particularly as new concepts and analytical tools were developed, and on the more applied level of comparison of market outcomes with institutional alternatives (Rutherford, 2001:186).

As Acemoglu et al (2005:397) remark, although cultural and geographical forces also matter for economic performances, differences in the quality of institutions are the major source of cross-country differences in economic growth and prosperity.

North (1990:3) defines institutions as the rules of the game in a society or, more formally, the humanly devised constrains that shape human interaction.

According to Alonso (2009:9), institutional structure defines the incentives and penalties that influence the behaviour of agents and shape collective action. Therefore, in the uncertain world in which independent agents operate with imperfect information, sound institutions reduce uncertainty and transaction costs and facilitate social coordination.

Acemoglu and Robinson (2012) argue that rich countries are rich because they have *inclusive* institutions, while poor countries are poor because they have *extractive* institutions. By "institutions" also the authors mentioned

above mean the rules that govern and organize the economic and political life. Inclusive institutions create the fundamental incentives and opportunities that stimulate investment and entrepreneurship, while extractive economic institutions consist of a system where a small group of people is permitted to exploit the rest of the population that is kept out the political and economic process. However, throughout the history most of the societies have been ruled by extractive economic institutions with different levels of intensity [44].

Acemoglu et al (2001) individuate the origins of the economic backwardness of former Western colonies in Asia, Africa and Latin America in the fact that colonial powers set up *extractive* state structures in those territories. Those institutions did not introduce much protection for private property, nor did they provide checks and balances against the government because the explicit aim of the Europeans settled in those overseas territories was the sole extraction of resources. This colonization strategy and the associated institutions contrast with the institutions Europeans set up in other colonies where they settled in large numbers, for example, the United States, Canada, Australia, and New Zealand (Acemoglou and Robinson, 2008:4).

At the same time the quality of institutions affected also economic development of the colonial powers themselves. Achemoglu at al (2002) argue that the discovery of America in 1492 with the consequent intensification of intercontinental trade via the Atlantic Ocean benefited in terms of economic development much more the countries that had already established a systems of checks and balance to the Monarchy, as Great Britain and the Netherlands, rather than countries where the monarchy was highly absolutist as in the case of Spain or Portugal.

The institutionalist explanation of disparities in economic development has been well received in academic circles and in the sphere of international organisations (Alonso, 2009:12).

As matter of facts, it has progressively arisen an increasing recognition among practitioners in international organizations that corruption and other aspects of poor governance have substantial and adverse effects on economic development (Mauro, 2002). Mauro (1995) also finds out a negative relationship between the malfunctioning of institutions and investment rate, therefore between institutional inefficiency (and corruption) and economic growth.

Somewhat contrary to the capital accumulation model of regional growth, institutional theorists argue that differences in growth and prosperity across countries, regions and cities are strictly related to the quality of political and economic institutions that shape the economic activity (Huggins and Thompson, 2017).

[44] In relation to "extractive" economic institutions in the ancient history, prominent historian MacMullen (1988) has argued that also the decline and consequent fall of the Roman Empire was mainly due to the progressive erosion of the solidity of government institutions pursued by a small group of high-ranking bureaucrats and military leaders. The spread of corruption and informal practices had long term devastating effects on the political and economic integrity of the institutional foundations Roman Empire.

By estimating the contribution to income levels of different forces as geography and trade in a large sample of countries, also Rodrik et al (2002) find out that the quality of institutions is the main determinant of income levels. Roughly said, after controlling for institutional quality, in the output of the regression model measures of geography and trade result at best to exert weak effects on income levels while the institutional quality remains the main determinant of economic development.

Turning to the more focused topic of regional performances in Europe, a wide body of literature has been produced to study the relationship between economic growth and the quality of institutions. However, most of these studies use "quality of institutions" as a predictor of economic growth with a "neoclassical approach" where economic growth is regressed on the natural logarithm of initial levels of GDP per capita and other control variables, including quality of institutions or regional geographic spillover (Ascani et al, 2012; Harris, 2008; Feldkircher, 2006; Rodríguez-Pose, 1998; Pons-Novell and Viladecans-Marsal, 1998). Other empirical studies assess the impact of the quality of institutions on innovative capacity and investment in European regions or countries (Rodriguez -Pose and Di Cataldo, 2018; Canton and Solera, 2016).

As matter of facts, once a marginal topic, the role of institutions has become one of the most popular research areas in development economics over the last 10–15 years (Chang, 2011).

However, the progressive recognition of the role of institutional quality as catalyst of economic development or economic growth in advanced economies that has taken place in the academia has not been completely internalized in the sphere of policy-making. As matter of facts EU policy prescription for regional cohesion during the last three decades has followed a "neoclassical approach" based on physical capital accumulation, human capital and innovation. As Rodriguez-Pose and Ketterer (2019) remark, the bulk of cohesion investments have been channelled towards improving the infrastructure endowment and accessibility of the least developed regions of the EU, as well as towards increasing the availability and quality of human resources, and developing the innovative capacity of individuals and firms across areas of Europe that have been lagging behind. In this framework EU institutions have paid little attention to the improvement of government institutions as a means to spur regional cohesion in the European Union.

5.3 Empirical Strategy and Data

The annual data are averaged from 2001 to 2015 for each of the 195 sampling units and the dataset includes 14 NUTS-1 territories (Belgium: Brussels; Germany: Berlin, Brandenburg, Bremen, Hamburg, Mecklenburg-Vorpommern, Saarland, Sachsen-Anhalt, Schleswig-Holstein and Turingen; France: Ile-de-France and Nord-Pas-

de-Calais; Greece: Attica; Spain: Community of Madrid; United Kingdom: Northern Ireland), 1 NUTS-0 territory (Luxembourg) and 180 NUTS-2 regions[45] located in EU-15 countries[46][47]. In the sample I include only the regions of Western Europe where the heterogeneity in terms of initial conditions is smaller (despite the remarkable cross country differences) than the cross regional heterogeneity observed in the post-enlargement European Union. Therefore regions of transition economies from Eastern Europe are not included in the sample because they outperformed the average rate of growth of the European Union despite their very low institutional quality and this is mainly due to the fact that they started with very low levels of income per capita their process of transition and economic integration with the Western countries of the European Union.

Data related to GDP per Capita and investment rates are sourced from Cambridge Econometrics European Regional Database.

The data concerning the educational attainment of the population are sourced from the regional database made available online from the European Commission.

Data related to the quality of regional governments consist of the EQI Score developed by Charron at al (2015) from *The Quality of Government Institute* of the University of Gothenburg and made available in the European Quality of Government Index (EQoG) database downloadable from the website of the Swedish academic institution. EQoG database is relatively new and the indicators have been developed only for the years 2010, 2013 and 2017.

Given the fact that the "success" or the "failure" of institutions reflects a wide range of historical, local, sociological and anthropological factors (Alesina, 2014; Greif, 1994), it is possible to suppose that changes and adjustments in the quality of institutions occur very slowly. Also Acemoglu and Robinson (2012:435) argue that replacing extractive institutions with inclusive institutions is neither an automatic nor a simple process. Indeed, it is often needed a convergence of historical or political factors, in particular a critical conjuncture combined with a broad coalition of people that support and push for the reforms.

As a consequence, for the purpose of this analysis the choice of "EQI Score" of the year 2013 as predictor of economic performances over the period 2001-2015 represents a very reasonable strategy to remedy the fact that the selected time series data for institutional quality are not available on annual basis from 2001 to 2015.

The estimation methodology applied in this essay partially follows the methodology developed by Ainginger et al (2013).

[45] Nuts 0 territories of Cyprus and Malta are excluded from the sample together with the 7 Nuts-2 Territories of Norway because of the lack of the availability of data concerning Quality of Institutions and because Norway is not a member state of the Union.

[46] Here, by EU-15 group it is meant all the Western member States of the European Union excluding Malta and Cyprus that joined the EU in 2004

[47] Sub-national data at NUTS-1, NUTS-2 and NUTS-3 level are not available for Luxembourg

Regions are assigned to 4 groups according to their economic performances over the period 2001-2015 and their initial income per capita levels:

1) Group A (Taking off from Above): Regions with GDP per Capita above EU GDP per Capita level in 2001 growing faster than the EU average over the period 2001 – 2015

2) Group B (Declining from above): Regions with GDP per Capita above EU GDP per Capita level in 2001 growing below the EU average over the period 2001 – 2015

3) Group C (Converging from below): Regions with GDP per Capita below EU GDP per Capita level in 2001 growing above the EU average over the period 2001 – 2015

4) Group D (Diverging from below): Regions with GDP per Capita below EU GDP per Capita level in 2001 growing below the EU average over the period 2001 – 2015

Regions assigned to group A and C will be further grouped together (A&C) in another group of "Successful regions". Regions assigned to group B and D will be further grouped together (B & D) in another group of "Unsuccessful regions" (or, symmetrically "Successful Regions" – A & C). Regions that recorded negative rates of income per capita growth will be grouped in the group of "failed" regions (Group E). The methodology developed in order to construct the binary dependent variables is explained in Table 1. After having constructed the four binary variables, with the Probit estimation it will be possible to estimate at first instance what are the structural features that increase (decrease) the probability that a region will be "Taking-off" (Diverging) with respect to European Union as a whole given its GDP per Capita in 2001. Then it will be possible to estimate both the conditional probabilities that a region will be "Successful" (or Unsuccessful) at performing better than the European Union as a whole in terms of economic growth and the conditional probabilities that a region will "fail" (negative growth) regardless of its GDP per capita levels in 2001.

Table 5.1 Economic performance		Has the region been "Taking-off"?	Has the region been "Declining"?	Has the region been "Converging"?	Has the region been "Diverging"?	Has the Region been "Successful"?	Has the Region been "Unsuccessful"?	Has the Region been "Failed"?
Taking-off Regions (Tanking-off from above) (A)	GDP per Capita in 2001 > EU GDP per Capita in 2001 & GDP per Capita Growth> EU GDP per Capita Growth	1	0	0	0	0	0	0
Declining Regions (Declining from above) (B)	GDP per Capita in 2001 > EU GDP per Capita in 2001 & GDP per Capita Growth < EU GDP per Capita Growth	0	1	0	0	0	0	0
Converging Regions (Converging From Below) (C)	GDP per Capita in 2001 > EU GDP per Capita in 2001 & GDP per Capita Growth < EU GDP per Capita Growth	0	0	1	0	0	0	0
Diverging Regions (Diverging from Below) (D)	GDP per Capita in 2001 < EU GDP per Capita in 2001 & GDP per Capita Growth < EU GDP per Capita Growth	0	0	0	1	0	0	0
Successful Regions (A & C)	GDP per Capita Growth > EU GDP per Capita Growth	0	0	0	0	1	0	0
Unsuccessful Regions (B & D)	GDP per Capita Growth < EU GDP per Capita Growth	0	0	0	0	0	1	0
Failed Regions E	GDP per Capita Growth < 0	0	0	0	0	0	0	1

5.4 Some further clarification about the sample selection criteria

In this analysis about institutions and economic growth I select only EU-15 regions because, as already mentioned, the heterogeneity in terms of initial conditions in 2001 was smaller (despite the remarkable cross country differences) than the cross regional heterogeneity observed in the EU-28 when also the post-enlargement countries are accounted for. Indeed, despite the very weak quality of government institutions, CEE countries and regions have outperformed the EU for a variety of well-documented and explored reasons.

First of all, all the CEE regions in 2001 had very low initial income per capita also relative to the poorer member states of the EMU like Greece and Portugal. Therefore the fact that those regions outperformed the EU can be considered as a mechanical outcome of the transition from centrally planned economy to market economy.

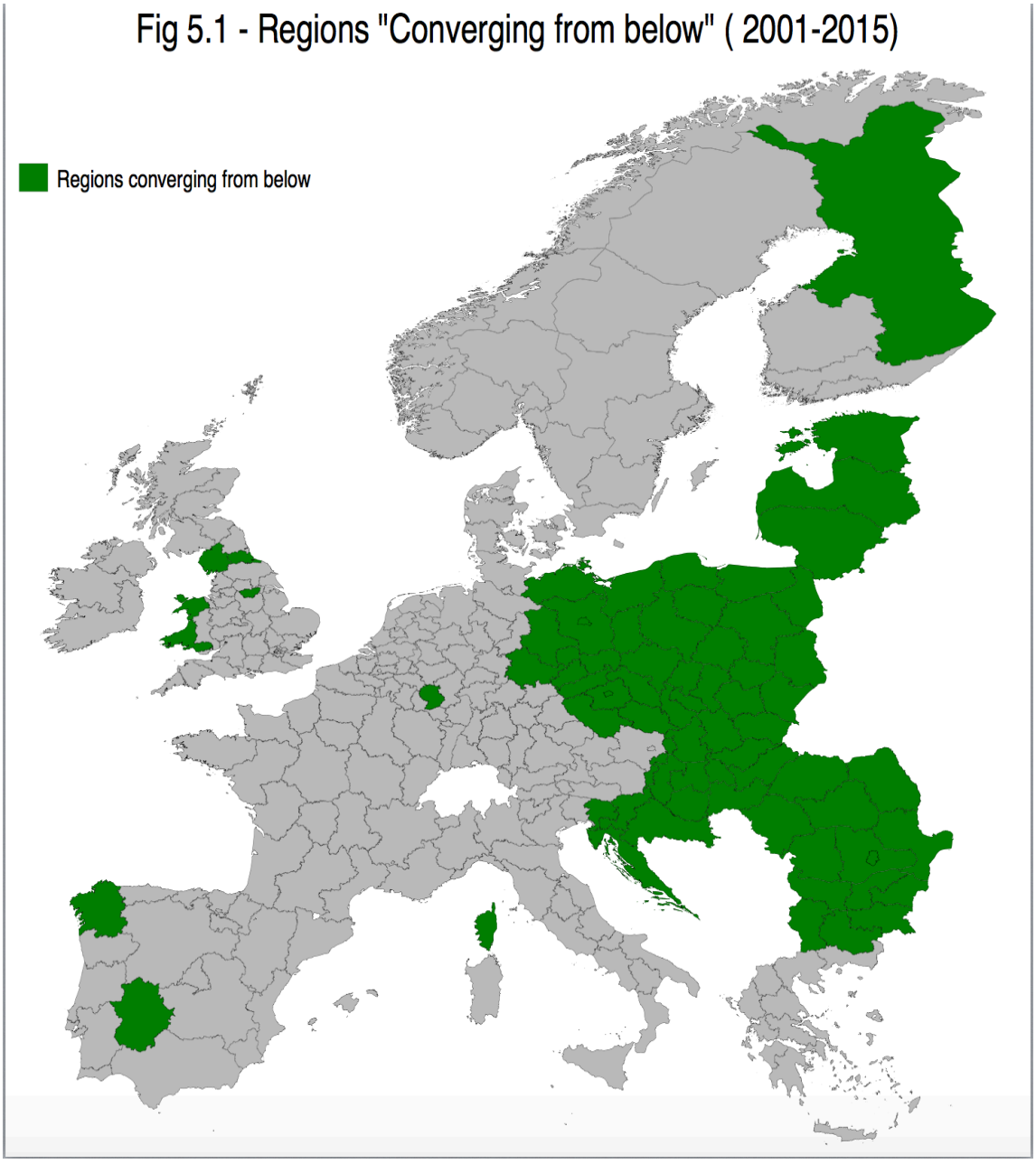
Second, CEE countries unleashed the inherent strengths of their economies by privatizing the state-owned enterprises and introducing comprehensive reforms concerning trade, competition, financial system and the labour market (Labaye et all, 2013). Furthermore, the progressive implementation of the "*acquis communitaire*" strengthened the confidence of international investors and foreign capital started to flow into these economies.

In a context of financial liberalization, Neoclassical Theory asserts that capital should flow from rich countries with high capital-labour ratios (or higher GDP per capita) to poor countries with low capital-labour ratios (or lower GDP per Capita), increasing capital per worker in the latter and thus contributing to economic growth and convergence (Abiad et al, 2007). In the case of CEE countries, foreign capital was also attracted by lower wages relatively to the "Western" European countries, educated labour force and geographical proximity to the "core" and wealthy regions of Europe. Therefore the great profitability of the investment opportunity represented by economic geography and cheap labour force offset the disadvantage represented by the weak quality of government institutions. As a consequence, since the mid of 1990s, CEE countries experienced an externally financed growth which does not have precedents in the economic history, establishing a record of growth and economic progress that few regions have matched (Friedrich et al, 2010).

Third, since the beginning of the process of integration in the European Union, CEE regions have been the major recipients of Structural and Cohesion Funds established within the EU budget to foster territorial cohesion in Europe (Mark et al, 2015).

This mix of factors led to an unprecedented rate of growth and convergence and as a consequence all the CEE regions fall into the classification (C) of regions "Converging from below" as individuated with the methodology explained in Table 5.1.

The statistical map 5.1 shows that during the period 2001-2015 in the European Union, 56 regions of out 72 regions that can be classified a “converging from below” are located in CEE countries.



5.5 Some Stylized facts about regional economic performances in the European Union

As already mentioned in the introduction, the period 2001-2015 was characterized on average by very poor regional economic performances because of the fact that most of the countries of the EU (and in particular in the EMU) were hit by severe financial and economic crises.

Figure 1 reports the average rates of regional economic growth observed within the EU as a whole and within the different subgroups of the EU.

As it possible to notice from Figure1 regional economic growth in the European Union was essentially driven by the "converging" economies of Eastern Europe.

Indeed, EU-15 regional average economic growth was nearly the half of the economic growth observed in the EU-28 over the period 2001-2015.

Fig 5.2 – Economic Growth by groups of countries 2001-2015

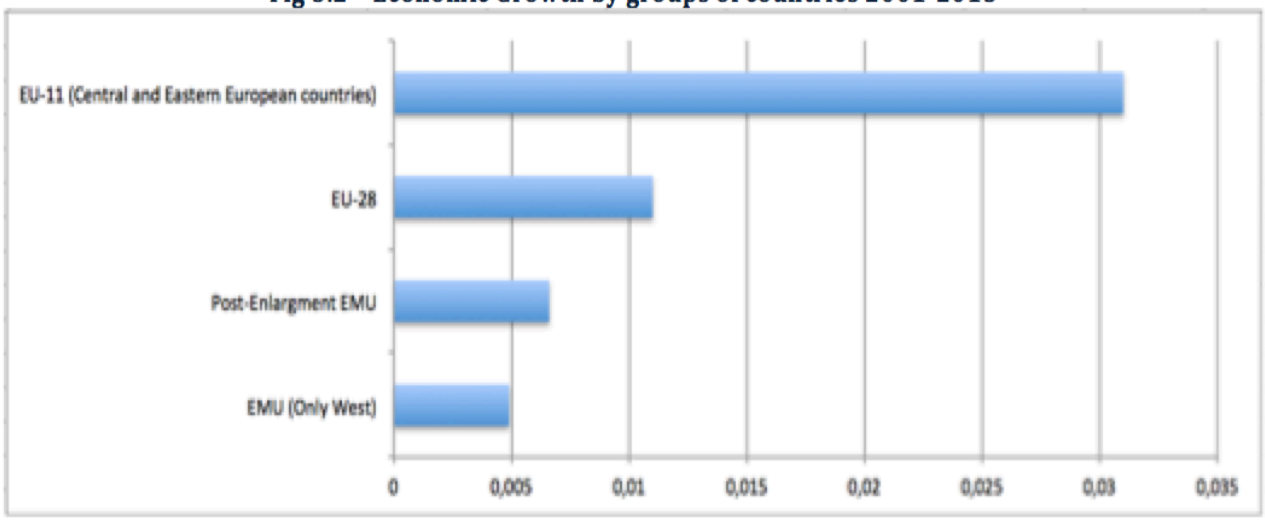
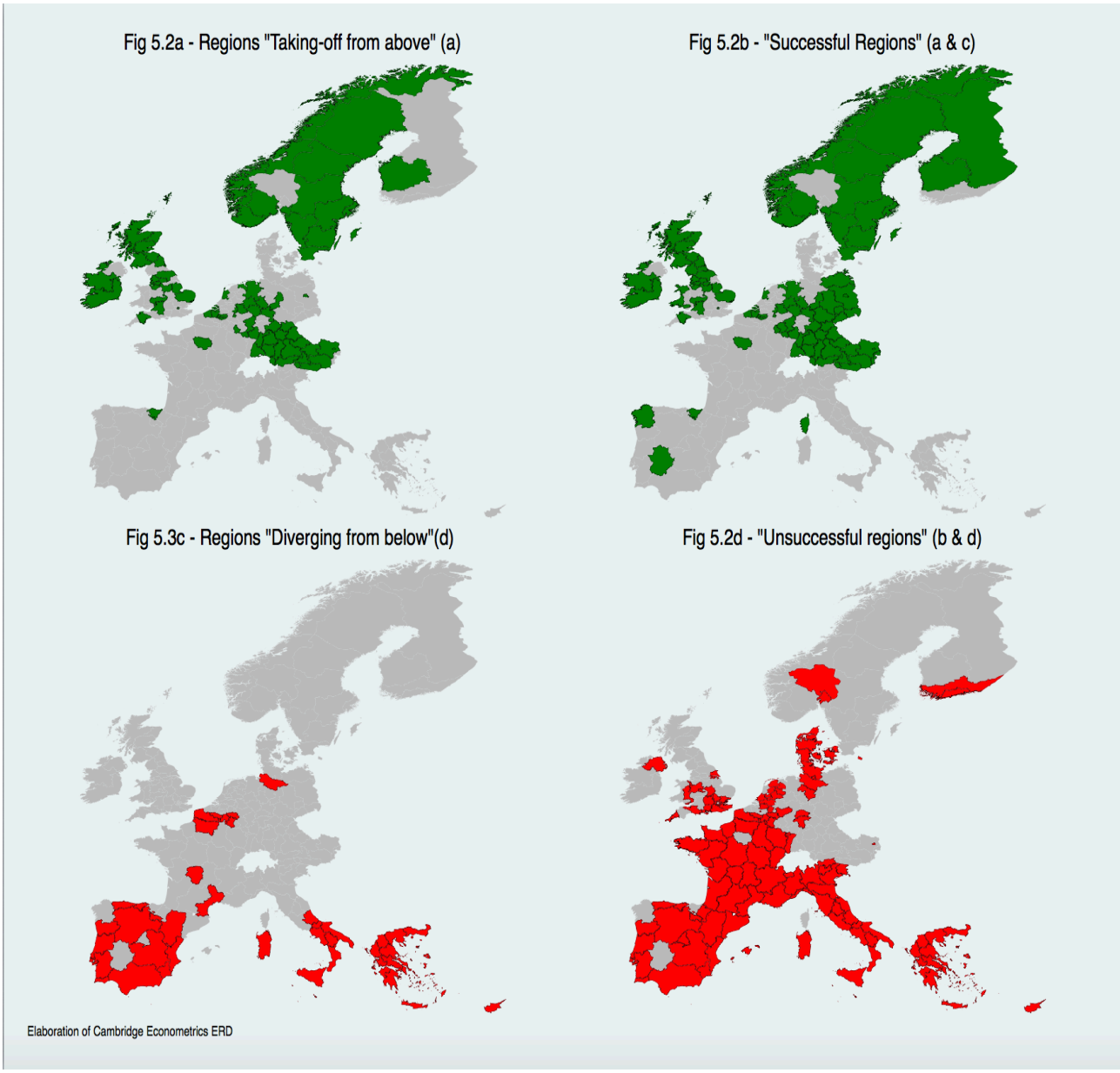


Figure 5.2 shows the statistical maps of regional performances A, B, A&C and B&D as formalized through the methodology developed in the Table 1.

As it is possible to note in Figure 5.2, most of regions with GDP per Capita lower than the European Union GDP per Capita in 2001 that underperformed the European Union (diverging regions) are located in Southern Europe while the regions that outperformed the European Union "from above" are mainly located in Central and Northern Europe (South-East and North Germany, most of Austrian regions, Scotland, North of England and Ile-de-France). Basque Country is the only Southern European region that has been "taking-off from above".

At the same time, most of the regions that have been "diverging from below" are located in Spain, Portugal, Italian "*Mezzogiorno*" while most of the regions that have been "unsuccessful" (either by "diverging from below"

or "declining from above") are located in Northern and Central Italy, France and in the Southern area of the Great Britain (South of England and Wales) plus Northern Ireland.



However the situation of Spain, Great Britain and France should not be absolutely confused with the situation of Italy and Greece. Indeed, as shown in Figure 3, most of the French (14 out 21), British (Wells and South of England) and Spanish (Community of Madrid, Catalonia and Navarra) "declining from above" regions or Spanish and Portuguese (all the regions excepted Metropolitan Area of Lisbon) "diverging from below" regions underperformed the European Union by recording positive (but lower than the EU) rates of economic growth.

All the Italian “declining from above” and Italian and Greek “diverging from below” regions underperformed the European Union by recording negative average rates of growth.

Fig 5.3a - Regions declining from above with average growth>0

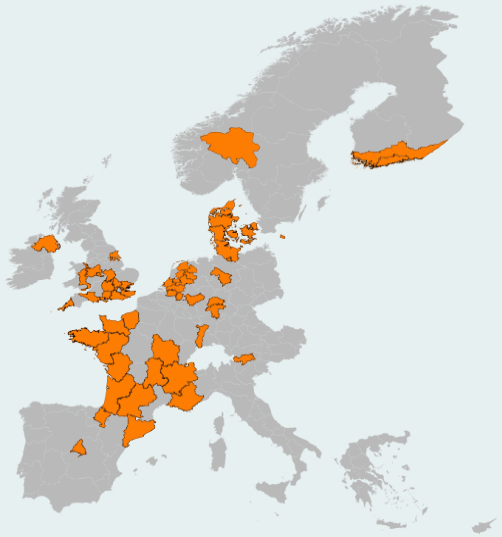


Fig 5.3b - Regions diverging from below with average groath>0

Fig 5.3c - "Failed Regions", average growth<0

Elaboration of Cambridge Econometrics ERD

5.6 Quality of Government Institutions across European regions, A Graphical Overview

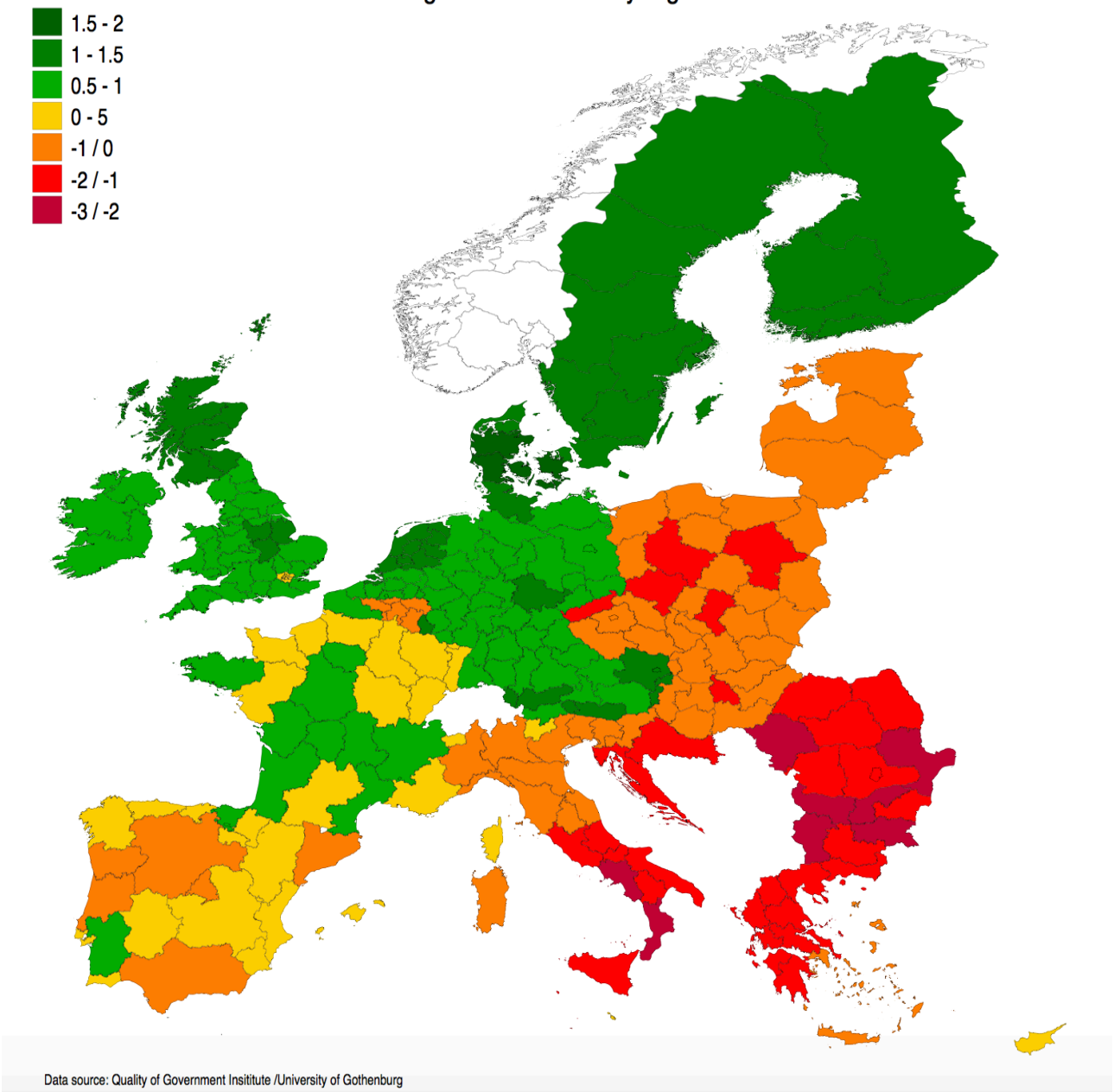
European Quality of Government Index (EQI) for the year 2013 has been developed by the *Quality of Government Institute of the University of Gothenburg* and it is the result of a regional survey answered by a large sample of 85.000 citizen respondents[48].

[48] In Appendix 5.1 I provide a more detailed definition of the EQI score

The data focus "*on both perception and experiences with public sector corruption along with the extent to which citizens believe various public sector services are impartially allocated and of good quality*".

Figure 5.4 shows the statistical maps of the regional EQI score as calculated for each region of the European Union (when the index it is not available at NUTS-2 level, the NUTS-2 region will take on the score of its upper level territorial unit NUTS-1).

Fig 5.4 - EQI score by region



Data source: Quality of Government Insititute /University of Gothenburg

As it possible to notice in Figure 5.4, EQI score tends to be generally very high or high in Northern and Central Europe (Scandinavian, German, Austrian and British regions), and roughly in the half of French regions.

At the same the quality of government tends to be poorer in Southern Europe. Situation appears quite alarming in the Italian "*mezzogiorno*" and Greece where the quality of regional government is comparable to the one of the regions located in the poorest countries of the European Union, namely Bulgaria and Romania.

Quality of government within the group of peripheral countries appears to be higher in Spain and Portugal whose regions performed much better than the Italian and the Greek regions.

As it is possible to note the quality of government institutions in CEE regions is generally poorer with some exceptions than in the EU-15.

5.7 The choice of Binary versus Linear Model to analyse regional convergence and divergence

Given the fact that I am interested in analysis how the quality of government institution has conditioned regional convergence on a cross section of regions, it is also possible to study this relationship with a "standard" OLS regression model where economic growth during the period 2001-2015 is regressed on the GDP per Capita in 2001, the Quality of Government Institutions and other control variables. However, for the purposes of this analysis, conditional convergence regression estimated on cross sectional data may lead to some shortcomings.

Indeed the objective of this chapter is not to study the emergence of core periphery patterns and increasing returns as in the previous chapter where a linear spatial lagged model on a cross section of regions demonstrated itself remarkably suitable to analysis geographical spillovers. Indeed, spatial spillovers and increasing returns may take place through "location effects" also between regions with relevantly different levels of economic or institutional development as in the case of the regions of Germany, Austria and of the countries of the Visegrad group or other Eastern European countries.

Rather, here I am interested in analysis how a given variable, Quality of Government Institutions, has shaped economic performances in regions with different initial levels of economic development. Therefore estimating a conventional model of conditional beta convergence would yield to the obvious result that on average poorer regions tend to outperform the richer ones conditional to the Quality of Government Institutions, taken as a determinant of the steady state.

In order to explain the reason behind the choice of binary model I initially specify the following linear model to be estimated with OLS estimator:

$$y_i = \alpha + \beta_1 \ln (x_{0,i}) + \beta_2 x_{2,i} + \beta_3 [\psi_{3,i}] + \mu_i$$

(5.1) (5.2)

Where y is the average rate of growth during the period 2001-2015 and x_0 denotes the GDP per Capita in 2001. X_2 denotes the EQI score and ψ denotes a vector of control variables that includes, among others, investment rate in manufacturing industry and the composition of human capital proxied as the educational attainment of the working age population. In the alternative specification of the model (2) I replace sectorial investment rates with the economic structures.

The output of the model is reported in Table 5.1[49].

Table 5.1 Dependent Variable: Average GDP per Capita growth 2001-2015	Number of obs = 195 Prob > chi2 = 0.0000 R2 = .60	Number of obs = 195 Prob > chi2 = 0.0000 R2 = .60
	Model 9a	Model 9b
Log of GDP pc in 2001	-.005*** [.001]	-.009*** [.002]
EQI Score	.004*** [.0008]	.004*** [.0007]
Working Age Population with Tertiary Education	.0001** [.00005]	.0002*** [.00005]
Working Age Population with Primary Education or Less	-.0002*** [.00004]	-.0001*** [.00004]
Investment in Industry to GDP	.0008*** [.0001]	
Investment in Construction to GDP	.0010375 [0006]	
Investment in non-Market Services GDP	.00005 [.0002]	
Investment in Market Services GDP	-.00007 [.0001]	
Investment in Agriculture to GDP	-.001* [.0007]	
Average GVA Industry		.00003 [.00009]
Average GVA Construction		-.00006 [.0002]
Average GVA non-Market Services		-.0003*** [.0001]
Average GVA Market Services		-.0002** [.0001]
Average GVA Agriculture		-.0004*** [.0001]

***Statistically Significant at 1% **Statistically Significant at 5% * Statistically Significant at 10%
Standard Error in Brackets [ ]

As it possible to note, while investment rate in manufacturing industry is confirmed to play a relevant role in the convergence process, the EQI score turns out to be the main determinant of economic growth and conditional convergence.

[49] In appendix 5.2 I will utilize the regression output of Table 5.1 in order to conduct an analysis for the eventual presence of multicollinearity among the variables in the model, especially those one related to sectorial investment rates.

However with this model it is only possible to conclude that there is a tendency of poorer regions to outperform the richer ones conditional, among others, on the quality of government institutions. Indeed with an OLS estimation for the whole sample of 195 regions it is not possible to differentiate initial conditions in 2001 (i.e. GDP per Capita) and the relationship with economic growth in the subsequent period. For example all the regions of Italian *Mezzogiorno* have been "diverging from below" the level of EU GDP per Capita in 2001 like most of the Spanish regions, but these two groups of regions are very different. In fact regions of Italian *Mezzogionro* have been "diverging from below" because they recorded negative rates of growth while the Spanish regions have been diverging from below because they recorded positive rates of growth below the EU economic growth.

The same can be said if economic performances of Italian regions are compared with the economic performances of the French regions. In fact, while all the French regions, excluding Ile-de-France (that has been a region "taking off from above"), have been "unsuccessful" as a consequence of the fact that they recorded positive rates of economic growth but underperformed the European Union, all the Italian regions have been "unsuccessful" as a consequence of the fact that they recorded negative rates of economic growth (the same can be told for Greek regions).

Given the statistical significance of the negative beta coefficient on GDP per Capita in 2001, the interpretation of the OLS regression output may lead to a misleading conclusion: both the "poor" regions of Italian Mezzogiorno (that recorded negative rates of growth) and the "poor" Spanish regions (that recorded positive rates of growth) are expected to convergence towards the income per capita levels of the richer Northern European regions conditional on a set of exogenous variable that includes the quality of government institutions. In other words, when interpreting the regression output it would not be possible to differentiate from Aquitaine (FR61) and Andalusia (ES61) that diverged with positive rates of growth and Campania (ITF2) and Calabria (ITF6) that diverged by recording negative rates of economic growth over the same period.

As a consequence, a Probit model estimated on different subsamples of regions grouped according to their economic performances and initial levels of GDP per Capita relatively to the European Union appears much more suitable to explain the relationship between regional performances and the quality of government institutions in the EU-15.

5.8 The Specification of the Model: a Probit analysis of the effects of Quality of Government Institutions on economic growth

Probit regression is nonlinear regression model specifically utilized for binary dependent variables. A model with binary dependent variable models the probability that Y=1 when a change in the predictor X occurs.

Cumulative probability distribution function (*c.d.f.*) is used in Probit regressions because it produces probabilities between 0 and 1 in the form (Y=1|X). Therefore, when Y is binary, its conditional expectation is the marginal probability that the variable Y equals 1, therefore the expected change arising from a change in X is the change in probability that Y=1 (Stock and Watson, 2012:431).

For the Probit model $F(x'\beta)$ is the cumulative density function (*C.d.f*) of a standard normal distribution[50]

$$Y= F(x'\beta)= \int_{-\infty}^{x'\beta} \Phi(z)\, dz \text{ with } \Phi(Z) \in [0, 1]$$

(2)

Therefore, coefficient estimate β represents the increase/decrease in the z-score of the probability Y=1|X when X changes by 1 unit.

The model is specified as follows:

$$Pr(Y=1|X's)= \Phi(\alpha + \beta_1 X_{1,i} + \beta_2 X_{2,i} + \beta_3 X_{3,i})$$

(3)

Where Y denotes binary dependent variable that can take on value 1 if a region has recorded a certain economic performance ("diverging", "converging", "unsuccessful"/"successful" or "failed") and 0 otherwise. X_1 denotes the EQI score calculated in 2013, X_2 denotes a vector of control variables related to sectorial investment rates to GDP or the regional economic structure while X_3 denotes vector of control variables related to the educational attainment of the working age population. All the variables other than EQI score are expressed as annual averages during the period 2001-2015.

The model will be estimated for four cases:

1) Regions "Taking-off" from Above
2) Regions "Diverging" from Below
3) Unsuccessful Regions (GDP per Capita Growth<EU GDP per Capita Growth)

[50] The application of a Logistic or Logit model yields very similar results, therefore I only focus in the estimation with Probit model

Or symmetrically, Successful Regions (GDP per Capita Growth > EU GDP per Capita Growth)[51]

4) Failed Regions (GDP per Capita Growth < 0)

Higher EQI score is expected to increase the probability that a region will be "taking off from above" or be "Successful" while it is expected to reduce the probability that a region will be "Diverging from below" or be "Unsuccessful". Investment rates to GDP are expected to affect the binary variable according to sector of the economy (Industry, Market services, Non-Market services, Agriculture and Constructions) while labour force higher education is expected to confirm the results common to the empirical literature about economic growth.

In the tables of the regression outputs I report directly the marginal effects or the predicted probability that Y=1 given the values of X_1 , X_2 …, X_k calculated by computing the z-value. Indeed, the coefficient β_1 is the change in z-value arising from a unit change in X_1, holding constant X_2 …, X. The Probit model is fitted with Maximum Likelihood estimator and provides also a Pseudo R Square[52, 53].

In order to provide a more in-depth analysis I also run the same models with variables averaged during the period 2001-2008. With this strategy it is possible both to exclude the crisis period characterized by a general drop in regional economic activity and to compare the role of institutions in the short run and in the long run[54].

[51] The coefficient estimates and their statistical significance of the models with "Successful" or "Unsuccessful" regions are exactly the same with opposite signs. Therefore in the paper only the regression output for "Unsuccessful" regions (regions "declining from above" and "diverging from below") is reported

[52] In the Appendix 5.2 I will report the regression diagnostics for the detection of the eventual presence of multicollinearity in the model. As it will be showed, no multicollinearity is detected between the variables in the model.

[53] In Figures 5.3.1 and 5.3.2 in Appendix 5.3 I report the plots of the marginal probabilities estimated with the Probit technique and reported in Tables 2, 3 4 and 5

Table 5.2: marginal effects on probability Y=1|X (A group in Table 1- "Taking off from above")	Number of obs = 195 LR chi2(8) = 79.86 Prob > chi2 = 0.0000 Pseudo R2 = 0.3376	Number of obs = 195 LR chi2(8) = 85.09 Prob > chi2 = 0.0000 Pseudo R2 = 0.3639
Model	1°	1b
	dy/dx	dy/dx
EQI Score	.27***	.22***
	[.075]	[.08]
Working Age Population with Tertiary Education	.003	.007**
	[.003]	[.003]
Working Age Population Primary Education or Less	-.002	-.0006
	[.003]	[.003]
Investment in Industry to GDP	.061***	-
	[.01]	
Investment in Construction to GDP	-.07	-
	[.07]	
Investment in non-Market Services GDP	-.046**	-
	[.02]	
Investment in Market Services GDP	.01	-
	[.009]	
Investment in Agriculture to GDP	-.20***	-
	[.06]	
Average GVA Industry		.016***
		[.005]
Average GVA Construction		-.022
		[.01]
Average GVA non-Market Services		-.014*
		[.008]
Average GVA Market Services		-.002
		[.01]
Average GVA Agriculture	-	-.028*
		[.01]

*** Statistically Significant at 1% ** Statistically Significant at 5% *Statistically Significant at 10%
Standard Error in Brackets [ ]

Table 5.3: marginal effects on probability Y=1|X (D group in table 1- "Diverging from below")	Number of obs = 195 LR chi2(8) = 124.04 Prob > chi2 = 0.0000 Pseudo R2 = .58	Number of obs = 195 LR chi2(8) = 139.35 Prob > chi2 = .0000 Pseudo R2 = .65
Model	2a	2b
	dy/dx	dy/dx
EQI Score	-.12.5***	-.137***
	[.03]	[.03]
Working Age Population with Tertiary Education	.003	.001
	[.003]	[.003]
Working Age Population Primary Education or Less	.005**	.003*
	[.002]	[.002]
Investment in Industry to GDP	-.009	-
	[.01]	
Investment in Construction to GDP	-.027	-
	[.03]	
Investment in non-Market Services GDP	.026**	-
	[.01]	
Investment in Market Services GDP	.010	-
	[.007]	
Investment in Agriculture to GDP	.021	-
	[.03]	
Average GVA Industry		.008
		[.005]
Average GVA Construction		.012
		[.01]
Average GVA non-Market Services		.026***
		[.007]
Average GVA Market Services		.013
		[.008]
Average GVA Agriculture		.021
		[.03]

*** Statistically Significant at 1% ** Statistically Significant at 5% *Statistically Significant at 10%
Standard Error in Brackets [ ]

Table 5.4: marginal effects on probability Y=1|X – Unsuccessful (B group +D group in table 1 - Regions "Declining from above" and regions "diverging from below")	Number of obs = 195 LR chi2(8) = 94.99 Prob > chi2 = .0000 Pseudo R2 = .34	Number of obs = 195 LR chi2(8) = 100.91 Prob > chi2 = .0000 Pseudo R2 = .36
Model	3a dy/dx	3b dy/dx
EQI Score	-.27*** [.08]	-.24*** [.08]
Working Age Population with Tertiary Education	.002 [.004]	-.0047 [.004]
Working Age Population Primary Education or Less	.013*** [.004]	.007* [.004]
Investment in Industry to GDP	-.037** [.01]	-
Investment in Construction to GDP	-.07 [.05]	-
Investment in non-Market Services GDP	.005 [.01]	-
Investment in Market Services GDP	.002 [.01]	-
Investment in Agriculture to GDP	.07 [.067]	-
Average GVA Industry		-.014** [.006]
Average GVA Construction		-.015 [.01]
Average GVA non-Market Services		.001 [.009]
Average GVA Market Services		.005 [.01]
Average GVA Agriculture		.01 [.01]

*** Statistically Significant at 1% ** Statistically Significant at 5% *Statistically Significant at 10%
Standard Error in Brackets [ ]

Table 5.5: marginal effects on probability Y=1|X – Failed (E group in table 1 - Regions with average growth <0")	Number of obs = 195 LR chi2(8) = 111.09 Prob > chi2 = .0000 Pseudo R2 = .54	Number of obs = 195 LR chi2(8) = 120.39 Prob > chi2 = .0000 Pseudo R2 = .58
Model	4a dy/dx	4b dy/dx
EQI Score	-.19*** [.038]	-.18*** [.03]
Working Age Population with Tertiary Education	-.006** [.003]	-.011*** [.003]
Working Age Population Primary Education or Less	-.0001 [.002]	-.001 [.002]
Investment in Industry to GDP	-.013 [.01]	
Investment in Construction to GDP	.007 [.03]	
Investment in non-Market Services GDP	-.017 [.012]	
Investment in Market Services GDP	.005 [.008]	
Investment in Agriculture to GDP	.006 [.03]	
Average GVA Industry		-.016*** [.005]
Average GVA Construction		-.007 [.01]
Average GVA non-Market Services		-.011** [.005]
Average GVA Market Services		-.012** [.006]
Average GVA Agriculture		-.006 [.008]

*** Statistically Significant at 1% ** Statistically Significant at 5% *Statistically Significant at 10 / Standard Error in Brackets [ ]

5.7 Robustness Check of the model: Institutions in the Short-Run

In order to further investigate the role of the quality of institutions in shaping regional economic performances in the EU-15, I run the same model with annual data averaged during the period 2001-2008.

With this strategy it will be possible to insulate the pre-crisis period and compare the long run and short run results of the econometric analyses in order to assess to what extent the quality of government institutions makes European regions more resilient to economic shocks.

As already mentioned the data for *European Quality of Government Index* (EQI score) developed by the *Quality of Government Institute* are available only for the years 2010, 2013 and 2017. Given the fact that changes in the quality of institutions occur very slowly it is plausible to suppose that the quality of government institutions observed in 2010 in the European regions was not sensibly different from the quality of government institutions that had characterised the period 2001-2008. As a consequence the EQI score of the year 2010 calculated on a survey of 34.000 respondents is chosen as a predictor of regions economic performance.

Also the *Quality of Government Institute* remarks that "*a relative stability in quality of government can be noted across the three editions*" of the database and such a stability further induces to confidently conjecture that quality of government institutions in 2010 was nearly the same of the quality of regional institutions of the pervious years.

The relationship between the quality of government institutions and economic performances in the short run is expected at best weak or negligible.

Indeed countries or regions can experience short run fast economic growth, convergence or growth accelerations regardless the quality of government institutions and as a consequence of episodes of speculation on real estate, stock market and commodity prices that drive economic growth until the bubble bursts and the subsequent macroeconomic adjustment. Furthermore during the periods of financial euphoria or financial/housing bubbles regions or countries with lower income levels can experience short-run periods of fast economic growth and convergence because of high debt-driven investment rates and decreasing returns to physical capital.

Anyways, stable economic development is ensured in the long sun only by sound government institutions as pointed out by Acemoglu and Robinson (2005).

The results of the regressions are reported in tables 6, 7, 8 and 9.

As it possible to note, the quality of institutions is the main factor behind a “taking-off from above” experienced form a region in the short run, while the quality of institutions plays no effects in shaping other regional economic performances.

Table 5.5: marginal effects on probability Y=1|X (A group in Table 1- "Taking off from above")	Number of obs 195 LR chi2(8) = 79.86 Prob > chi2 = 0.0000 Pseudo R2 = 0.31	Number of obs 195 LR chi2(8) = 85.09 Prob > chi2 = 0.0000 Pseudo R2 = 0.26
Model	6°	6b
	dy/dx	dy/dx
EQI Score	.29***	.34***
	[.06]	[.06]
Working Age Population with Tertiary Education	.010***	.011***
	[.003]	[.004]
Working Age Population with Primary Education or Less	.0028	.002
	[.003]	[.003]
Investment in Industry to GDP	.028**	
	[.012]	
Investment in Construction to GDP	.045	
	[.04]	
Investment in non-Market Services GDP	-.067***	
	[.01]	
Investment in Market Services GDP	.03	
	[.02]	
Investment in Agriculture to GDP	-.008*	
	[.05]	
Average GVA Industry		.00080
		[.005]
Average GVA Construction		.028**
		[.014]
Average GVA non-Market Services		-.014*
		[.008]
Average GVA Market Services		-.012
		[.009]
Average GVA Agriculture		-.048**
		[.02]

*** Statistically Significant at 1% ** Statistically Significant at 5% *Statistically Significant at 10%
Standard Error in Brackets [ ]

Table 5.6: marginal effects on probability Y=1|X (B group in table 1- "Diverging from below")	Number of obs 195 LR chi2(8) = 33.38 Prob > chi2 = 0.0000 Pseudo R2 = .19	Number of obs 195 LR chi2(8) = 64.4 Prob > chi2 = .0000 Pseudo R2 = .37
Model	7°	7b
	dy/dx	dy/dx
EQI Score	-.042	-.039
	[.03]	[.03]
Working Age Population with Tertiary Education	-.005	-.008*
	[.004]	[.004]
Working Age Population Primary Education or Less	.003	.0034*
	[.002]	[.001]
Investment in Industry to GDP	.001	
	[.01]	
Investment in Construction to GDP	-.04	
	[.03]	
Investment in non-Market Services GDP	.011	
	[.01]	
Investment in Market Services GDP	.008	
	[.01]	
Investment in Agriculture to GDP	.003 .	
	[.03]	
Average GVA Industry		-.001
		[.006]
Average GVA Construction		.003
		[.018]
Average GVA non-Market Services		.023***
		[.008]
Average GVA Market Services		-.0083
		[.009]
Average GVA Agriculture		-.008
		[.009]

*** Statistically Significant at 1% ** Statistically Significant at 5% *Statistically Significant at 10%
Standard Error in Brackets [ ]

Table 5.7: marginal effects on probability Y=1|X – Unsuccessful (B group +D group in table 1 - Regions "Declining from above" and regions "diverging from below")	Number of obs = 195 LR chi2(8) = 22.5 Prob > chi2 = .004 Pseudo R2 = .18	Number of obs = 195 LR chi2(8) = 100.91 Prob > chi2 = .0000 Pseudo R2 = .19
Model	8°	8b
	dy/dx	dy/dx
EQI Score	.013	.006
	[.06]	[.06]
Working Age Population with Tertiary Education	-.016***	-.018***
	[.005]	[.004]
Working Age Population Primary Education or Less	.001	.0062*
	[.003]	[.003]
Investment in Industry to GDP	-.01	
	[.01]	
Investment in Construction to GDP	-.08	
	[.05]	
Investment in non-Market Services GDP	-.01	
	[.01]	
Investment in Market Services GDP	-.003	
	[.027]	
Investment in Agriculture to GDP	-.09	
	[.06]	
Average GVA Industry		-.015**
		[.006]
Average GVA Construction		-.072***
		[.015]
Average GVA non-Market Services		-.011
		[.009]
Average GVA Market Services		-.021**
		[.009]
Average GVA Agriculture		-.039**
		[.018]

*** Statistically Significant at 1% ** Statistically Significant at 5% *Statistically Significant at 10%
Standard Error in Brackets [ ]

Table 5.8: marginal effects on probability Y=1|X – Failed (E group in table 1 - Regions with average growth <0")	Number of obs = 195 LR chi2(8) = 18.27 Prob > chi2 = .0000 Pseudo R2 = .54	Number of obs = 195 LR chi2(8) = 12.26 Prob > chi2 = .0000 Pseudo R2 = .41
Model	9°	9b
EQI Score	.0008	.008
	[.01]	[.01]
Working Age Population with Tertiary Education	-.001	-.001
	[.001]	[.001]
Working Age Population Primary Education or Less	-.0005	-.00005
	[.0007]	[.0009]
Investment in Industry to GDP	-.002	-.002
	[.005]	[.002]
Investment in Construction to GDP	-.003	
	[.01]	
Investment in non-Market Services GDP	.001	
	[.004]	
Investment in Market Services GDP	.010	
	[.006]	
Investment in Agriculture to GDP	-.016	
	[.02]	
Average GVA Industry		-.002
		[.002]
Average GVA Construction		.003
		[.004]
Average GVA non-Market Services		-.003
		[.003]
Average GVA Market Services		.0001
		[.001]
Average GVA Agriculture		-.005
		[.008]

*** Statistically Significant at 1% ** Statistically Significant at 5% *Statistically Significant at 10 / Standard Error in Brackets [ ]

5.8 Discussion of the Results

Despite the results of the model perfectly fit the expectations derived from the theory and the previous empirics in the literature, it is surprising to empirically demonstrate how the quality of institution turns out to be the most important determinant of regional performances even compared to investment rate in highly productive sectors as manufacturing industry. In particular when controlling for sectorial investment rates to GDP, a percentage point increase in EQI score is expected to determine an increase of 27% in the probability that a region will be "taking off from above" (Table 2 Model 1a) while it is expected to reduce by 15% the probability that a region will be "diverging" from below (table 3, Model 1a).

The results of the model reported in Table 4 (Model 1a) also tells that a one unit increase in the EQI score will reduce by 27% the probability that a region will be "unsuccessful" either "declining from above" or "diverging from below". Symmetrically, a one unit increase in the EQI score will increase by 27% the probability that a region will be successful either in "taking off from above" or "converging" from below.

Beside the quality institutions, the role investment in manufacturing industry to GDP seems to be very relevant to increase in probability that a region will be "taking off from above" as reported in Table 2 and to reduce the probability that a region will be "Diverging from below" or "unsuccessful" (Table 3 and Table 4). Therefore the results of this analysis indirectly confirms the empirics of chapter 4 where manufacturing activity is found to be the engine of economic growth and convergence across the European regions.

As regards the "failed" regions (table 5), the industrial sector size plays a marginal role while the EQI score is the main determinant of regional performances because a one unit increase in the EQI score is expected to reduce by 19% the probability that a region will "fail" to grow.

Human capital proxied as the educational attainment of the working age population generally plays an effect in shaping regional performances, in particular the labour force with primary education or less is expected to increase the probability that a region will be "diverging from below" or "unsuccessful" while the labour force with tertiary education is expected to reduce the probability that a region will fail to grow.

5.9 Conclusions

As in the most of the analyses on economic growth I provided a model that includes indicators for human capital (proxied as the educational attainment of the working age population) and physical capital accumulation (investment rate in the different sectors of the economy). The first noteworthy result is that manufacturing

industry, either investment rate or its size, plays always a positive role in shaping positive regional economic performances, thus confirming the empirical findings of Chapter 3 and 4.

However, empirical evidence from Western European regions shows that preeminent role in shaping regional economic performances is played by the quality of government institutions. The coefficient estimates for the explanatory variable EQI are always statistically significant within a 99% confidence interval and their magnitude is always remarkably much larger than the magnitude of coefficient estimates for variables like investment rate in manufacturing industry (or the size of industrial sector) or the educational attainment of the working age population.

According to the estimations, EQI score is the most relevant variables in explaining positive ("taking off from above" or "successful") and negative ("diverging from below" or "unsuccessful") economic performances. The results of the model clearly confirm the thesis of Acemoglu and Robinson (2012) about to the tight relation between quality of institution and failures of nations, or regions in our case. As shown in the statistical map (Figure 4), most of the regions with very low indices of the Quality of Government Institutions are the regions of Southern Europe, in particular the Italian and the Greek ones. Those regions were also the ones that suffered more from the financial crisis and sovereign debt crisis (they have been regions "diverging from below") while most of the Northern Italian regions with income higher than EU income levels in 2001 have been "declining" from above or unsuccessful.

According to the estimations, a one unit increase in EQI score is expected to increase by 27% the probability that a region will be "taking off from above" (Table 2, model 1a), while it will reduce by 12.5% the probability that a region will be "diverging from below" (Table 3, Model 2a). Finally, a one unit increase in the EQI score is expected to reduce by 27% the probability that a region will be "unsuccessful" either by "diverging from below" or "declining from above" (Table 4, Model 3a)[55].

The empirical finding of this paper are very relevant for governments in diverging or declining regions of the European Union, mainly in the peripheral countries of the EMU. Indeed the results show how the Quality of Institutions ends up to be the most relevant determinant of regional economic performances. In particular, the regression output for "diverging from below" regions (Table 3) clearly shows that for regions, whose per capita income is lower that the per Capita income of the European Union as a whole, the quality of institutions is much more important than other variables such as the investment rate in manufacturing sector or it size.

[55] Symmetrically a one unit increase in EQI score is expected increase by 27% the probability that a region will be "successful" with a 99% confidence interval

Indeed according to the coefficient estimates reported in Table 3 (Model 2a), a one unit increase in the EQI score is expected to reduce by 12.5% the probability that a region will be "diverging from below" while the coefficient estimates investment rate in industry or the size of the industrial sector are not statistically significant.

Quality of Government Institutions exerts a huge impact on the probability that a region will be "unsuccessful" by either "diverging from below" or declining from above". According the regression output reported in table 4 (model 3a), while a 1% increase in investment rate in industry is expected to reduce by 3.7% the probability that a region will be "unsuccessful", a one unit increase in the EQI score is expected to reduce by 27% (more than one quarter) the probability that a region will be "unsuccessful" either by "declining from above" (as in the case of all the Northern and Central Italian regions) or "diverging from below" as in the case of the Greek regions.

Last but not least, according to the estimations reported in Table 5, one unit increase in the EQI index is expected to reduce by 19% (Model 4a) or 18% (Model 4b) the probability that a region will fail to grow.

During the period under analysis 20 Italian regions out of 21 and 10 Greek regions out of 13 recorded negative average GDP per capita growth, meaning that over the same period, 31 regions out of 44 European Regions that recorded negative economic growth were Greek or Italian. The two countries are also the countries with the lowest quality of regional institutions in terms of EQI score. Given these further considerations and the empirical evidence provided by the econometric estimations, it is straightforward to conclude that the quality of institutions is the main determinant of regional economic performances in the long run. As a consequence it is possible to assert that the weak quality of institutions has hampered both the resilience of Northern Italian regions to the financial crisis and their ability to "take-off from above" as in the case of the most industrialized regions located in Germany. At the same time, the weak quality of government institutions has remarkably contributed to the process of "divergence from below" observed in the Greek and Southern Italian regions. As empirically estimated and reported in Table 3, the quality of government institutions is much more relevant than the investment rate in the manufacturing industry for lower income regions to avoid further divergence from the EU income levels.

Furthermore, by comparing the results estimated for the same model in the long run and in the short run, it is also possible to assert that the soundness of government institutions makes regions more resilient to financial crisis or macroeconomic shocks. As matter of facts Greek regions, that recorded high rates of economic growth before the financial crisis, have recorded the worst economic performances in Europe over the period 2001-2015 together with the Italian regions.

According to Rothstein and Uslaner (2005), the quality of government institutions mainly reflects the *social trust* that characterizes a local community and many empirical studies show that higher degrees of social trust are generally associated with higher levels of quality of government institutions.

Lack of *social trust* within a community means that citizens have faith only in their family, clan or social group and this makes them less eager to contribute to the provision of general public goods, such as paying taxes, respecting and protecting public spaces and, very importantly, engaging in social and political mobilisations asking for improvements in quality of government. Generally speaking, free-riding becomes more frequent at all social levels. In turn, public authorities lack both adequate resources and incentives to deliver policies, consolidating a "vicious cycle" (Charron et all, 2012:10).

In this framework, central governments in peripheral countries (especially in Italy and Greece) should focus their efforts on promoting a set of institutional reforms aimed at breaking up the nexus between the lack of *social trust* in local communities and political clientelism, thus reforms aimed at breaking the linkages between decentralised governance and rent extraction by private parties, social groups or local bureaucrats. These sets of reforms would be very effective especially in countries like Italy where central government assigns large autonomy to regional governments in the management and provision of costly public services in the framework of a process of progressive devolution of the power from the State to regions.

However, given the fact that there is no a "one-size fits all" approach to curbing corruption, any measures must take into consideration the political, economic and social environment of a country and address the root causes of corruption rather than adopting a symptomatic approach (Lee-Jones, 2018).

Such tailor-made institutional reforms should be accompanied by both the set up of national independent authorities responsible for monitoring and combatting corruption and the introduction of a more stringent code of laws to prosecute episodes of corruption of public officials or policy-makers.

Besides reforms at national level, quality of government institutions should also be enforced by the European Commission through a system of incentives and penalties for the allocation of regions Structural and Cohesion Funds. In particular funds should be granted to regions also on the basis on their progress in implementing governance best-practices and institutional convergence in terms of transparency and anti-corruption measures.

Appendix 5.1. Composition and Definition of the EQI score

EQI score is developed by the *The Quality of Government Institute* of the University of Gothenburg within the framework of a European Commission-funded project on measuring the Quality of Government Institutions in the European Regions.

The index is built on the largest survey ever undertaken to measure the Quality of Government (EQoG) at sub-national level.

In order to capture the most relevant sub national variation in EQoG, surveyors focus on three public services that are often financed, administrated and politically accounted for by subnational authorities: Education, Healthcare and Law Enforcement.

Surveyors asked respondents "*to rate these three public services with respect to three related concepts of QoG – the quality, the impartiality and the level of corruption of said services*".

The regional data combine 16 survey questions about the Quality of Government in a region.

To construct the regional index, surveyors followed carefully the guidelines provide in the "Handbook on Constructing Composite Indicators; Methodology and User Guide" published in 2008 by the OECD.

All the QoG questions are aggregated from the individual to regional level. Next the 16 regional scores are standardised so as to obtain a common range via standardisation.

Then the standardised scores are assigned to three different groups named "pillars" containing scores related to question about *impartiality*, *corruption* and *quality*. Each variable is given the same weight in each pillar. Finally the three pillars are combined using equal weighting to form the regional index (Charron et al, 2012).

Appendix 5.2: Analysis of Eventual Presence of Multicollinearity in the Model

Multicollinearity occurs when a high correlation is detected among the predictors in a regression model. More precisely, multicollinearity arises when one of the regressors is a perfect linear combination of the other regressors.

In the case of the model specified in this article, investment rates in the different sectors of the economy (or the share of a sector of the total GVA) may be correlated, especially averaged over the long period. For example an increase in investment in the constructions, a very important steel-using sector, may be positively correlated to an increase in the investment rate in the manufacturing activity involved in the production of steel.

A first possible strategy to check for multicollinearity is to examine the correlation matrix of the predictors, where correlation coefficients would indicate the presence of multicollinearity. Therefore the pairwise correlation coefficients between two explanatory variables would be close to 1 if a regressor is a linear function of another regressor.

Tables 10 and 11 report respectively the pairwise correlations between the classes of investment rates and between the sectorial components of the total Gross Value Added.

Table 5.2.1:

	Investment in Industry to GDP	Investment in Construction to GDP	Investment in non-Market Services GDP	Investment in Market Services GDP	Investment in Agriculture to GDP
Investment in Industry to GDP	1				
Investment in Construction to GDP	0.0491	1			
Investment in non-Market Services GDP	-0.0230	0.5567	1		
Investment in Market Services GDP	-0.1743	-0.2238	-0.1493	1	
Investment in Agriculture to GDP	0.0880	-0.0676	0.1690	0.2020	1

Table 5.2.2:

	GVA Average Industry	Average GVA Construction	Average GVA non-Market Services	Average GVA Market Services	Average GVA Agriculture
Average GVA Industry	1				
Average GVA Construction	-0.1947	1			
Average GVA non-Market Services	-0.3552	0.1765	1		
Average GVA Market Services	-0.6467	0.0798	-0.2434	1	
Average GVA Agriculture	-0.0350	0.3607	0.1267	-0.0578	1

Figures 5.2.1 and 5.2.1 show the plot of the correlation matrix of investment rates and GVA shares respectively.

Fig. 5.2.1 - Plotted graph of the Correlation Matrix of investment rates by economic activity

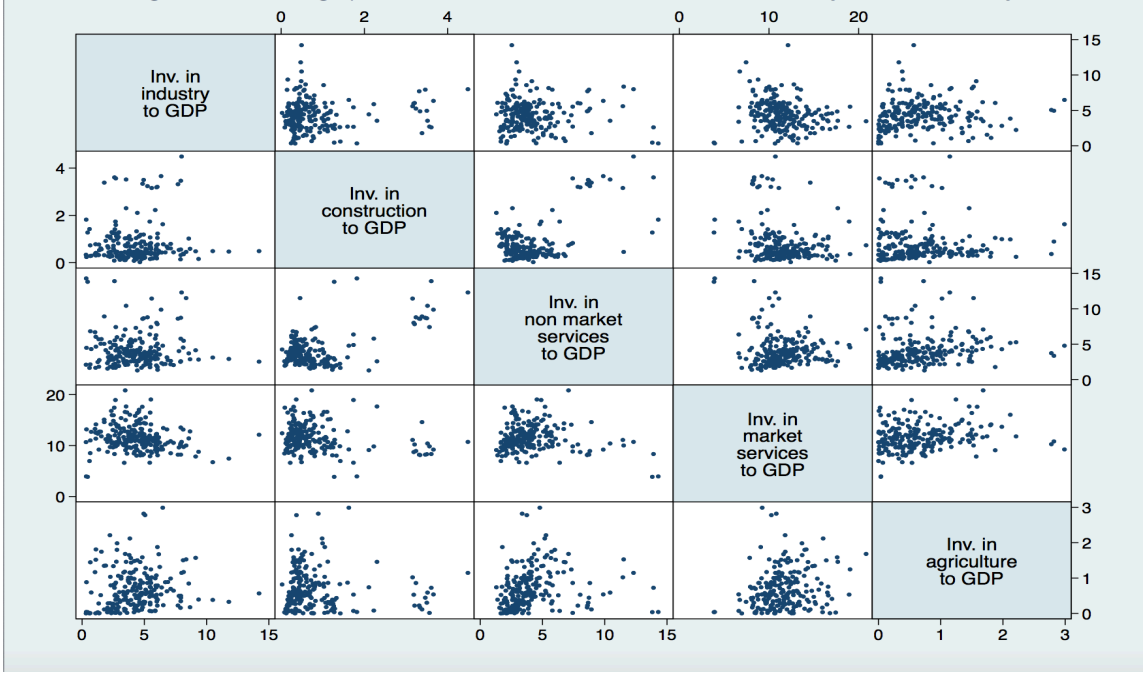
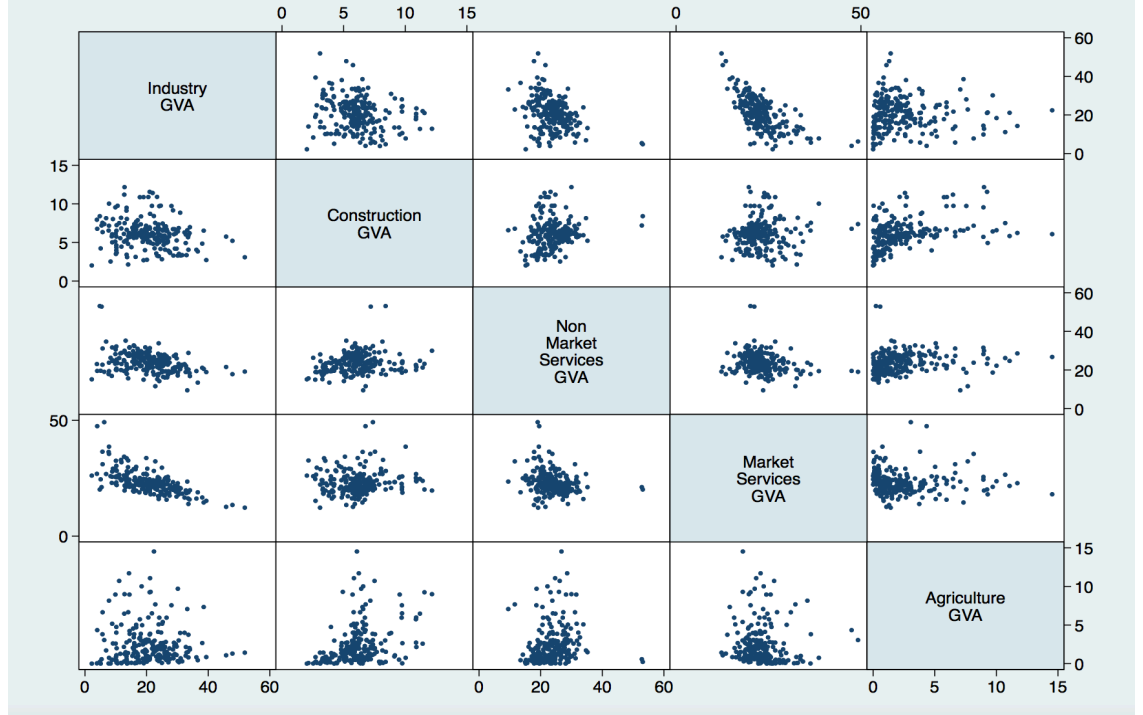


Fig. 5.2.2 - Plotted graph of the Correlation Matrix GVA share by economic activity



According to the correlation coefficients reported in Tables 5.2.1 and 5.2.2 (and their graphical representations), the predictors included in the models do not seem be collinear or linearly dependent. Indeed in Table 10 the larger correlation coefficient in absolute terms is the one detected between investment rate in construction and investment rate in non-market services (-.55). In Table 11 the larger correlation coefficient in absolute terms is the one detected between industry GVA and GVA in market services (-.64).

All the correlation coefficients in absolute values lay below the threshold of 0.50.

Despite the correlation matrix analysis indicates that there exists no a multicollinearity problem in the model, I also perform the Inflation Variance Factor (IVF) test.

In order to perform this test it is necessary to perform an OLS regression because the IVF is an index that measures to what extent the variance of the estimated regression coefficient is increased as a consequence of multicollinearity.

Let Rj^2 indicates the coefficient of determination of a regression equation in which x_j is regressed on all the other predictors of the model.

Let VIF_j be determined as $VIF_j = 1/ (1-Rj^2)$ for j=1,2,…p-1. Therefore when Rj^2 is equal to 0 the VIF_j would be equal to 1 ($=1/ (1-0^2)$), meaning that the j^{th} is not linearly related with the other predictors. Symmetrically when Rj^2 is equal to 1 (the highest possible coefficient of determination), the VIF_j would be equal to ∞ ($=1/ (1-1^2)$), meaning the j^{th} is linearly related with the other predictors.

The rule to establish whether there exists multicollinearity within a model is provided by Montgomery (2001) that individuates VIF threshold values. If the VIF values exceed 5 or 10 it means that the model is poorly estimated because of the presence of multicollineriaty.

Once the OLS model has been estimated as in equations 5.2 and 5.3 (Table 5.2) of Paragraph 5.7, it is possible to estimate the VIF for each variable. The estimation for the two models is reported in Table 5.2.4.

Table 5.2.4: VIF

IVF Model 9a		IVF Model 9b	
EQI Score	4.05	GVA Manufacturing Industry	4.44
Working Age Population with Primary Education or Less	3.48	Log of GDP pc in 2001	4.10
Investment in Construction to GDP	2.44	Market Services GVA	3.51
Log of GDP pc in 2001	2.35	Non-Market Services GVA	3.42
Working Age Population with Tertiary Education	2.35	Working Age Population Primary Education or Less	3.22
Investment in non-Market Services GDP	2.09	EQI Score	2.77
Investment in Agriculture to GDP	1.48	Construction GVA	2.11
Investment in Maunufacturing Industry	1.21	Working Age Population with Tertiary Education	2.07
Investment in Market Services GDP	1.18	Agriculture GVA	1.77

The estimation of the VIFj's confirms the absence of multicollinearity in the model. Furthermore when running regression analysis with the econometric software, variables that are perfectly correlated are always automatically dropt form the model in order to estimate the coefficients.

Appendix 5.3. Plots of Marginal Probabilities

Fig 5.3.1 - Average Marginal Effects with respect to investment rates and EQI score
(95% CIs)

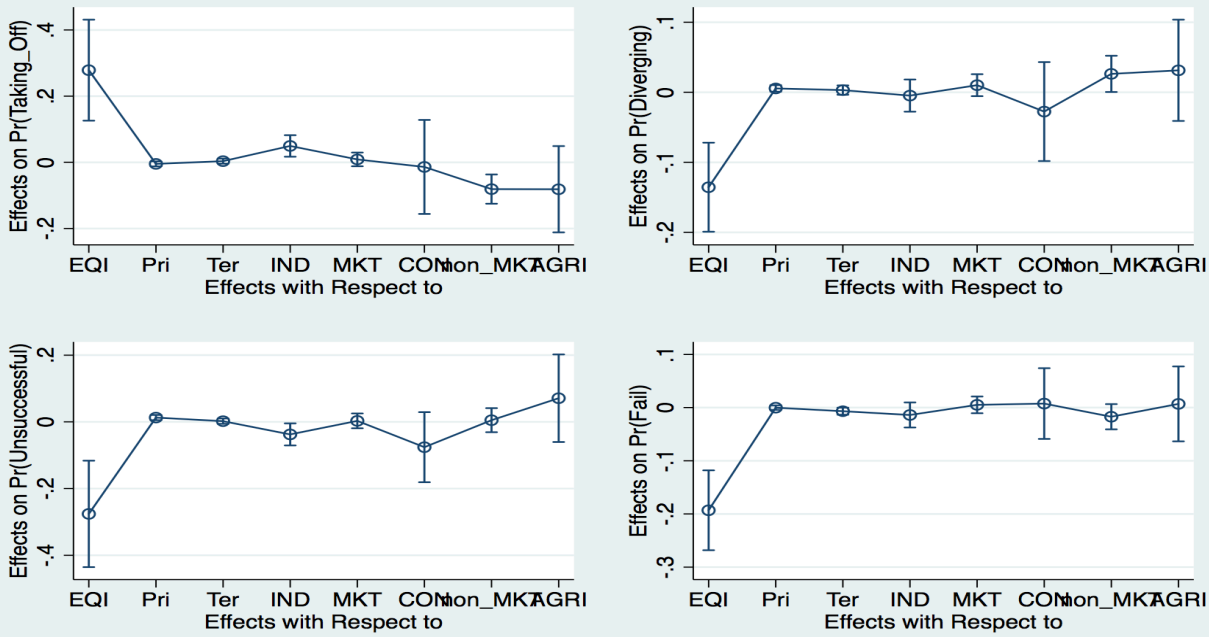
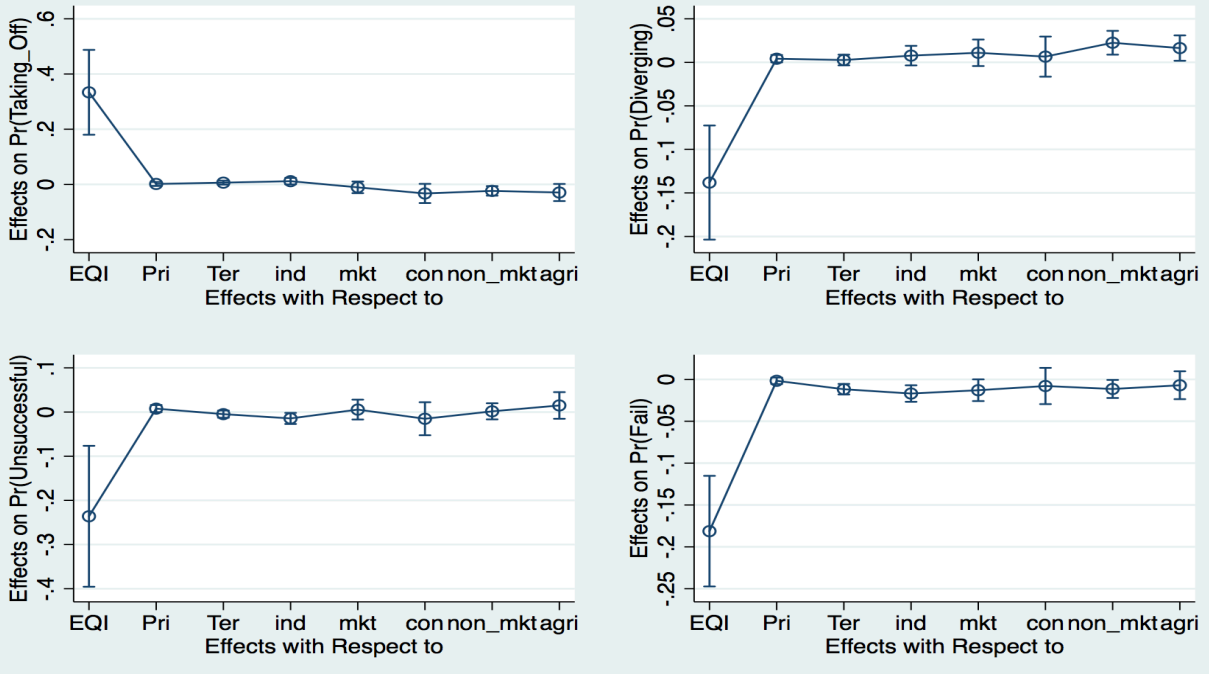


Fig 5.3.2 - Average Marginal Effects with respect to economic structure and EQI score
(95% CIs)



General Conclusions and Discussion

Motivated by the increasing public interest for the economic issues related to the EMU arisen after the outbreak of the Global Financial Crisis and the sovereign debt crisis accompanied by the double dip recession, this dissertation has contributed to shed a light on the determinants of the economic trends observed in Europe since the intensification of the process of European economic integration. In particular I have highlighted the different aspects that may have contributed to the progressive weakening and the consequent reversal of the process of convergence across Western countries and regions in the Economic and Monetary Union.

Within the framework of the Neoclassical Theory, in the first chapter of the thesis I have showed that convergence between the "Western" member states of the European Union has gradually reversed with the intensification of the process of economic and monetary integration since the end of the 1980s. This reversal of catching up in the "West" of the EU has been matched by a shift of the convergence process towards East. As matter of facts convergence in the EU during the period 1995-2018 is observed only thanks to the progressive integration of the CEE economies within the economic area.

In this framework it is possible to assert that, while the EU-15 no longer configures as a convergence club as it did until the mid of the 1990s, only CEE economies (especially the Visegrad group) can be expected to converge towards the incomes per capita of the richer countries of the EU.

Given the empirical evidence shown in the First Chapter, in Chapter 2 I initially compared the rates of growth and the primary government balances observed in the aggregate Euro Area and in the US during the period 1995-2018 and the sub-period 2008-2018 that has followed the outbreak of the Global Financial Crisis. Starting from the empirical observation that, during the period 1995-2018, the US and the Euro Area have followed opposite strategies of fiscal policies, I have hypothesized that the difference in growth performances observed in the two sides of the Atlantic could be ascribed to the contractionary fiscal policy pursued by the countries of the EMU.

The difference in the approach to government fiscal policy has been particularly relevant during the period 2009-2018 when the US recorded an average primary deficit at values around -5% while the Euro Area recorded an average primary surplus (Fig, 2.4, Chapter 2). As matter of facts, in 2009 immediately after the outbreak of the Global Financial Crisis the Euro Area started to consolidate its primary fiscal balance while the in the US opted to pursue expansionary fiscal policy to support the economic recovery.

Then, I tested the hypothesis whether the permanent fiscal consolidation and the monotonic fiscal rules, entailed by the Maastricht convergence criteria and EMU membership, may have undermined economic growth in its

member states and contributed the progressive deterioration of the process convergence between countries that joined the Economic and Monetary Union between 1999 and 2001. The results of the longitudinal panel analysis during the period 1995-2018 are remarkably interesting because they show that the strict fiscal discipline (reflected by the government primary surplus) entailed by the EMU membership have penalized economic growth in particular in the countries that were supposed to catch-up with the ricer ones. As a consequence permanent fiscal consolidation and austerity, that in some countries got harsher in the aftermath of the Global Financial Crisis, can be identified as the major cause behind the divergence in income per capita observed since the mid of the 1990s in the Economic and Monetary Union.

Starting from the evidence that central government fiscal consolidation to be pursued through the annual accumulation of primary government surpluses has been detrimental for convergence since the mid of the 1990s, in Chapter 3 I tested the hypothesis of whether fiscal consolidation as policy response to the outbreak of the Global Financial Crisis has also been the cause of the double dip recession observed in Europe during the period 2007-2015, and therefore the cause of the patterns of regional divergence observed since the year 2007-08.

Thanks to the availability of econometric models specifically suited to build and estimate regression equations on data linked by a hierarchical relationship, namely Multilevel Mixed Effects Models, I have been able to estimate the effect of government fiscal austerity and consolidation on "within country" regional economic growth.

The results of the Multilevel Mixed Effects Model estimated on a longitudinal panel dataset built on three-year non-overlapping averages confirm at regional level the analysis Heimberger (2016) according to which fiscal consolidation or austerity as policy response has been the main culprit for the double dip recession observed in Europe after the outbreak of the global financial crisis. The results of the model are very interesting for two reasons.

First, it is demonstrated that the objective to pursue fiscal consolidation was a misleading policy strategy for economic recovery in most of the countries of the EMU after the outbreak of the Global Financial Crisis. In other words austerity is generally not expansionary. Second, the effects of fiscal consolidation on regional economic growth in the Economic and Monetary Union have varied and vary from country to country.

Indeed with the multilevel regression technique I have been able to estimate the random slopes to be added up to the fixed slope for the whole sample of regions and I showed that fiscal consolidation has penalized

particularly *within country* regional growth in the periphery, where each percentage point of austerity or fiscal consolidation has been associated to a drop of regional GDP per capita larger that 1 percentage point.

Conversely, fiscal consolidation has been associated to *within country* regional economic growth in Germany and Austria and with negligible drops of economic activity in Belgium and Finland.

The empirical evidence that post-2008 fiscal consolidation has penalized regional growth more in the peripheral countries than the "core" countries explains the paths of regional divergence observed during the sub-periods 2007-2009, 2010-2012 and 2015-2015 as shown in Figure 3.6 of Chapter 3. At the same time the asymmetric effects of fiscal consolidation also explain the process of regional divergence observed during the period 2001-2015.

Therefore, in chapters 2 and 3 it has been shown that both programs of fiscal consolidation to qualify for the EMU membership in 1999 and fiscal austerity after the outbreak of the global financial crisis have been detrimental to convergence both between countries and regions.

Besides putting into evidence the role of fiscal consolidation in shaping regional economic performances after the outbreak of the Global Financial Crisis, the results Chapter 3 also show the remarkable effect of investment in manufacturing industry as driver of regional economic growth during the period 2007-2015 (Model 3.1a, Chapter 3). As matter of facts aggregate investment rate exerts no effect on GDP but, if the variable is disaggregated in its main components (manufacturing industry, market services and non-market services), it is possible to find out that only the variable investment rate in manufacturing industry has statistically significant effects on the economic activity.

Starting from the empirical evidence that investment in manufacturing industry was the driver of economic growth during the period that encompasses the fiscal austerity-induced double dip recession in Europe, in Chapter 4 I have conducted an in-depth analysis of the relationship between the geographical distribution of manufacturing industry and regional development in the European Union. The empirical evidences from this chapter essentially complement the results of Chapters 2 and 3 to explain the shift of convergence process from the periphery of the EMU to Central and Eastern Europe. On the one hand, tight government fiscal policy and austerity have undermined convergence both between countries and regions in the EU-15. On the other hand the European enlargement has favoured the progressive relocation of manufacturing activity around the core European regions located in Germany and Austria and this process benefited in particular the regions of the Visegrad Group that actually experienced an exceptional process of catching-up that has not precedents in the economic history (Friedrich et al, 2010). In fact, as shown in Fig 4.3.1 (Appendix 4.3, Chapter 4), during the

period 2001-2015 there was a relevant tendency of manufacturing activity to relocate towards Northern and CEE regions of the European Union. As a consequence, while the manufacturing contribution to total GVA shrank in almost all the French, Italian and British regions or remained stable in most of Spanish regions, during the period 2001-2015 it has been possible to observe a remarkable increase in the size of manufacturing industry GVA in the rage of 3-12% in almost all the German, Austrian and Visegrd regions.

The shift of manufacturing industry towards CEE regions located around the German and Austrian core also determined a strong convergence in the labour productivity in manufacturing industry itself that in turn led to remarkably strong convergence rates in labour productivity and income per capita of the former towards the levels of latter ones (Table 4.2 and Figure 4.4a and 4.4b Chapter 4).

Therefore, tight government fiscal policy since the mid of the 1990s and fiscal austerity since 2008 in the EMU together with the progressive relocation of manufacturing industry from most of the peripheral regions of the EMU and France towards Central and Eastern European regions can be individuated as the two complementary determinants of the shift of the convergence process from the periphery of the EMU towards the CEE countries as outlined in Chapter 1. As also Stollinger et al (2013) remark, the economic crisis of 2008 has caused a change in the perception of the manufacturing sector in many countries among both economists and policy-makers. Manufacturing has redeemed its reputation in the sense that a comparatively large manufacturing sector is no longer considered to reflect an outdated economic structure, inadequate for a postindustrial, services-dominated economy such as the EU. Rather, nurtured by the observation that within the EU, countries that have maintained a larger manufacturing base fared better during and after the crisis, a dynamic manufacturing sector is again considered to be a prerequisite for an innovative and fast-growing economy.

Finally in the 5th Chapter I have tested the hypothesis that also the quality of government institutions plays a very relevant role in shaping regional economic performances, thus in determining economic performances at country level.

In particular in this chapter I have quantified the extent to which the quality of government institutions has determined patterns of regional convergence and divergence in the EU-15.

The results of this analysis are very relevant because it is shown that, besides factors beyond government control such as fiscal policy in the Economic and Monetary Union and tendency of manufacturing industry to relocate around the core regions, there is still a margin for domestic political authorities in the peripheral countries like Italy at least to soothe the severity of divergence experienced by the poorest regions. In fact, according to the regression output reported in Table 5.3 one per cent improvement in the quality of government

institutions is expected to reduce by 12.5% the probability that a "poor" region will underperform the European Union. At the same time one per cent improvement in the quality of government institutions is expected to reduce by 19% the probability that a region will "fail to grow" as it happened in almost all the Italian and the Greek regions, in six French regions and a couple of Spanish regions during the period 2001-2015.

In summary, although the process of convergence in the EU-15 started to deteriorate during in the early 1990s in coincidence with the Maastricht Treaty, it is not theoretically and empirically possible to individuate a direct relationship between the introduction of the Single Currency *per se* and the deterioration and the reversal of the convergence process in the EU-15. Rather it is possible to individuate two major groups of drivers of divergence that have accompanied the process of European monetary integration and that have to be analysed from different theoretical perspectives and with different econometric approaches.

A first dimension of the process of divergence in the EU-15 pertains to the branch of fiscal policy and its relationship with economic growth, that is, to the fiscal consolidation underlying the EMU membership and to the fiscal austerity as policy response to the Global Financial Crisis outbreak. In fact it is possible to assert that it was the contractionary fiscal policy, in particular after the financial crisis outbreak, rather than the Single Currency *per se* to generate divergence across countries and regions in the EU-15.

The second dimension of the process of divergence pertains to the branch of the theory of trade and economic geography. As Krumgan (2020:3) points out, analytical papers about economic geography represent an attempt to make sense of global patterns of trade and the location of industries.

In fact, the process of European monetary integration has proceeded in parallel with the process of economic globalization that entailed the progressive reduction of trade barriers and increasing cross-boarders capital mobility in the World economy. The rise of a global market for goods and services following the entry into force of the WTO agreement in 1995 and the manufacturing firms' search for competitive advantages, to be achieved through scale economies, has naturally led to the emergence of a global value chain based on the regionalization of industrial activity also favoured by regional economic agreements like the EU or NAFTA (Stollinger et a, 2015; Ravenhill, 2011; Hill, 2011; Held at all, 2010; Gilpin, 2008).

As matter of facts, also a report published by the Vienna Institute of International Economic Studies (Stollinger, 2016:1) confirms that the manufacturing activity in the EU has increasingly agglomerated in a European manufacturing core centred on Germany and comprising Austria as well as the four Visegrad countries and this agglomeration within and around particular EU regions depends on the international production integration that

has determined a German-Central European supply chain that is exporting manufacturing goods to the rest of Europe and the world.

In the light of these empirical evidences and considerations, it appears evident the urgent need for an upgrade of the European "*convergence machine*" in order to restore convergence in the Economic and Monetary Union.

A set of reforms should be aimed at alleviating the grip of fiscal austerity in the weaker countries of the EMU through the introduction of risk-sharing mechanisms on the sovereign debts. As also Bernoth and Engler (2015:1) have pointed out, one problem with regard to the longer-term stability of the euro area is the absence of mechanisms to adequately absorb asymmetric cyclical shocks in the individual member states. Such an instrument is essential in order to be able to implement a single monetary policy suitable for all countries.

As a consequence of this evidence, it has been produced a wide set of proposals that entail mechanisms that range from the introduction of a European stabilization fund (De Grauwe and Ji, 2016; Pasimeni, 2015) to the mutualisation of the portion government debt ratio exceeding the 60% or the 90% of the GDP (Corsetti et al, 2015; Parello and Visco, 2012). However the implementation of such measures would entail a very high degree of political integration and "solidarity" as in the case of the US after the adoption of the Constitution in 1790 (Steinbach, 2015) and does not appear a feasible option at least in the short-medium term in the case of Europe.

As matter of facts most of the proposals under evaluation by the EU institutions are primary focused on strengthening and fostering market discipline for governments of the member states of the currency area (Morlino and Sottilotta, 2020; Rehn, 2018; Meyland and Schäfer, 2017). Such enhanced market discipline would be preordained to the completion of the European Banking Union but would also entail the transformation of government bonds held by the domestic banking systems in "risk-weighted" assets for the levels of banks' capital requirement. The eventual implementation of this reform proposal of the European financial regulation would force countries with high level of debt to GDP ratio to further tighten fiscal austerity for two reasons.

On the one hand, domestic governments would be forced to recapitalize banks whose capital/asset ratio has shrunk because of the weight assigned to government bond held in their balance sheets. On the other hands, domestic banks would be pushed get rid of government bonds causing an increase of interest rates on those government bonds. In this framework, governments in the peripheral countries, whose debt to GDP ratio increased sharply after the outbreak of the Global Financial Crisis, would be obliged to implement further and harsher fiscal austerity measures aimed at the reduction of government debt in order not to put bank deposits and private savings at risk[56].

[56] Such a proposal has been contested by the Italian Ministry of Economy and Finance during a 2016 ECOFIN (Wall Street Journal, 2016; Reuters, 2016)

As it is appears clear, the implementation of such proposal and the consequent implementation of further austerity measures in the peripheral member states with high debt to GDP ratios would further exacerbate divergence across the countries and regions of the Economic and Monetary Union.

However these considerations pertain to political debate and to the European intergovernmental negotiations surrounding the completion of the EMU, and such a debate is not the subject of this dissertation.

Rather, the debate surrounding the upgrade of the European "*convergence machine*" should be focused with equal intensity on a "*manufacturing imperative"* (Rodrik, 2016 and,2011). Indeed, deindustrialization has long been a concern in rich nations, where it is associated in public discussions with the loss of good jobs, rising inequality, and a potential decline in innovation capacity.

For this reason Myro (2019) outlines the need of a European policy for a new industrial revolution where cooperation between countries must also be reinforced towards a more effective and wider common EU industrial policy. As also Stollinger et al (2013) remark, industrial policy, understood as selective government interventions attempting to alter the structure of production towards industries that are expected to offer higher growth prospects, can in principle try to foster structural change towards any sector or industry that government authorities consider to be 'strategic' or supportive of growth. Viewed through the lenses of a "*manufacturing imperative*" perspective, the particular characteristics of manufacturing industries (such as externalities and increasing returns to scale) call for industrial policies that redirect the European economy towards manufacturing activities and aim at strengthening or restoring the industrial commons.

Bibliography

Abiad, A.; Leigh, D. and Mady, A (2007) *International Finance and Income Convergence: Europe is Different*. International Monetary Fund Working Paper No. 07/64

Accetturo, A. , Aimone, L. and Beretta, E. (2015) *Deindustrializzazione e terziarizzazione: trasformazioni strutturali nelle regioni del Nord Ovest*. [Deindustrialization and Tertiarization: Structural Transformations in the region of North-West. Bank of Italy Occasional Paper

Acemoglu, D. and Robinson, J. A. (2012) *Why Nations Fail. The Origins of Power, Prosperity*, and Poverty. New York: Crown Business

Acemoglu, D. and Robinson, J. (2008) *The Role of Institutions in Growth and Development*. The International Bank for Reconstruction and Development / The World Bank On behalf of the Commission on Growth and Development. Working Paper No.10

Acemoglu, D., Johnson, S. and Robinson, J. A. (2005) *Institutions as Fundamental Cause of Economic Growth*. In

Acemoglu D., ., Johnson, S. and Robinson, J. A. (2005a) *The Rise of Europe: Atlantic Trade, Institutional Change, and Economic Growth*. NBER Working Paper No. 9378

Acevedo, M.F. (2013) *Data Analysis and Statistics for Geography, Environmental Science, and Engineering*. New York: CRC Press (Taylor & Francis Group)

Aghion, P. and Durlauf, S. (2005) *Handbook of Economic Growth* 1A. Amsterdam: Elsevier B.V.

Aghion, P.; Howitt, P. and Mayer-Foulkes, D. (2004*) The Effect of Financial Development on Convergence: Theory and Evidence*. NBER Working Paper No. 10358

Aiginger, K.; Firgo, M. and Huber, P. (2013) *What can the EMU's Peripheral countries Learn from Regional Growth*? In Lacina, L., Rosmahel, P. and Rusek, A. (2013) *Political Economy of the Eurozone crisis. Reforms and their Limits*. Mendel European Centre

Alcidi, C. (2019) *Economic Integration and Income Convergence in the EU*. CEPS Forum

Alesina, A.; Favero, C. A. and Giavazzi, F. (2018*) What do we know about the effects of Austerity?* NBER Working Paper No. 24246

Alesina, A.; Favero, C. and Giavazzi, F. (2014) *The Output Effect of Fiscal Consolidations*. NBER Working Paper No. 18336

Alesina, A.; Barbiero, O.; Favero, C. and Giavazzi, F. and Paradisi, M. (2013) *Austerity in 2009-2013*. NBER Working Paper No. 20827

Alesona, A. and Perotti, D. (1997) Fiscal Adjustments in OECD Countries: Composition and Macroeconomic Effects. International Monetary Fund, 44, (2), pp. 210-248

Alesina, A. and Perotti, R. (1996) *Fiscal Adjustments in OECD Countries: Composition and Macroeconomic Effects*. NBER Working Paper No.5730

Alonso, J. A. (2009) *Colonisation, formal and informal institutions, and development*. ICEI Working Paper No.13

Álvarez López, E. ; Myro Sánchez, R. and Vega Crespo, J. (2011) *Delocation in manufacturing sectors in the EU. A Regional Overview*. Investigaciones Regionales, 22, pp. 5-34

Anselin, L.; Florax, R. and Rey , S. J. (2004) *Advances in Spatial Econometrics: Methodology, Tools and Applications*. Berlin: Spinger

Ascani, A; Crescenzi, R. and Iammarino, S. (2012) *Regional Economic Development: A Review*. Search Working Paper 1/03

Atkins, R. (2011) *ECB resignation hits Global Markets*. The Financial Times, 9th September 2011. Retrieved from: https://www.ft.com/content/790ba3ba-daec-11e0-a58b-00144feabdc0. Accessed: 14th December 2019

Barro, R. J. (1996) *Determinants of Economic Growth. A Cross-Country Empirical Study*. NBER Working Paper 5698

Barro, R.J. and X. Sala-i-Martin (1995). *Economic Growth*. New York: McGraw-Hill.

Barro, R. J. and Sala-i-Martin (1992) *Convergence.* The Journal of Political Economy 100 (2), 223-251

Barro, R. J. and Sala-i-Martin (1991) *Convergence Across States and Regions*. Brookings Papers on Economic Activity 22(1), 107-182

Barro, R. J. (1991) *Economic Growth in a Cross Section of Countries*. The Quarterly Journal of Economics 106 (2), pp. 407-443

Barro, R. J. and Sala-i-Martin (1990) *Economic Growth and Convergence across The United States*. NBER Working Paper No. 3419

Barro, R. J. (1974) *Are Government Bonds Net Wealth?* Journal of Political Economy, 82 (6), pp. 1095-1117

Bassanini, A. and Scarpetta, S. (2001) *The Driving Forces of Economic Growth: Panel Data Evidence for the OECD Countries*. OECD Economic Studies No.33

Baumol, W. J. (1986) *Productivity Growth, Convergence and Welfare: What the Long-Run Data Show*. The American Economic Review, 76 (5), 1072 – 1085

Bernat, A. J. (1996) *Does manufacturing matter? A Spatial Econometric View of Kaldor's Law*. Journal of Regional Science, 36 (3), pp. 463-477

Ben-David, D. (1998) *Convergence Clubs and Subsistence Economies*. Journal of Economic Development, 55 (2), pp- 153-169

Ben-David, D. (1997) *Convergence Clubs and Diverging Economies*. CEPR Discussion Papers 922

Bernanke, B. S. (2015) *Germany's Trade Surplus is a Problem*. The Brookings Institution. Retrieved from: https://www.brookings.edu/blog/ben-bernanke/2015/04/03/germanys-trade-surplus-is-a-problem/. Accessed: 7th November 2019.

Bernoth, K. and Engler, P. (2015) *Fiscal Risk Sharing and Stabilization in the EMU*. Managing Risks in the European Periphery Debt Crisis, 1(1), pp. 148-162

Borsi, M. and Metiu, N. (2015) *The evolution of economic convergence in the European Union*. Empirical Economics, 48 (2), pp. 657-681

Brasili, C; Bruno, F. and Saguatti, A. (2012) *A spatial econometric approach to EU regional disparities between economic and geographical periphery*. Statistica, 72 (3), pp.299-316

Buti, M. and Turrini, A. (2015) *Three waves of convergence. Can Eurozone countries start growing together again?* VOX CEPR Policy Portal. Retrieved from: https://voxeu.org/article/types-ez-convergence-nominal-real-and-structural . Accessed: 15th January 2020.

Buiter, H. W.; Corsetti, G. and Roubini, N. (1992) *Excessive Deficits: Sense and nonsense in the Treaty of Maastricht*. Economic Growth Center Discussion Paper No.674

Canova, F; Cutinho, L. and Kontolemis, Z. (2012) *Measuring the macroeconomic resilience of industrial sectors in the EU and assessing the role of product market regulations*. European Commission Occasional Papers 112/212

Cabral, R. & Castellanos-Sosa, F. A., (2019) *Europe's income convergence and the latest global financial crisis* Research in Economics, Elsevier, vol. 73(1), pp. 23-34

Canton, E. and Solera, I. (2016) *Greenfield Foreign Direct Investment and Structural Reforms in Europe: What Factors Determine Investments?* European Commossion, European Economy Discussion Paper No. 033

Chang, H. J. (2011) *Institutions and economic development: theory, policy and history*. Journal of Institutional Economics, 7 (4), pp. 473–498

Chang, H. J. (2003) *Kicking away the Ladder. Development Strategy in Historical Perspective*. London: Anthem Press

Charron, N., Dijkstra, L. and Lapuente, V. (2015) *Mapping the Regional Divide in Europe: A Measure for Assessing Quality of Government in 206 European Regions*. Social Indicators Research, 122 (2), pp. 315-346

Charron, N., Dijkstra, L. and Lapuente, V. (2012) *Regional Governance Matters. A study on Regional Variation in Quality of Government in the EU*. European Commission Working Paper No. 01/2012

Chatterji, M. (1992) *Convergence Clubs and Endogenous Growth*. Oxford Review of Economic Policy, 8 (4), 75-76

Checherita-Westphal, Jacquinot, P., Burriel, P., Manuel Campos, M. Caprioli, F. and Rizza, P. (2018) *Economic consequences of high public debt and lessons learned from past episodes*. Banco de Portugal Occasional Papers

Ciccone, A. (2001) *Agglomeration Effects in Europe and the USA*. CREI Working Paper N.9

Ciotoli, G.; Voltaggio, M. Tuccimei, P.; Soligo, M.; Pasculli, A., Baubien, S.E. and Bigi, E. (2017) *Geographically weighted regression and geostatistical techniques to construct the geogenic radon potential map of the Lazio region: A methodological proposal for the European Atlas of Natural Radiation*. Journal of Environmental Radioactivity, 166 (17), pp. 355-375

Coad, A. and Vezzani, A, (2017) *Manufacturing the future: is the manufacturing sector a driver of R&D, exports and productivity growth?* JRC Working Papers on Corporate R&D and Innovation No 06/2017

Collignom, S. (2011) *European Monetary Policy under Jean-Claude Trichet*. European Parliament, Directorate for Internal Policies

Corsetti, G., L. P. Feld, P. R. Lane, L. Reichlin, H. Rey, D. Vayanos, and B. Weder de Mauro. (2015) *A new start for the Eurozone: Dealing with debt, Monitoring the Eurozone 1*. CEPR Press.

Croci Angelini, E. and Farina, F. (2016) *Integration without convergence in the European Currency Area*. In Guderzo, M. and Bosco, A. (2016) *A Monetary hope for Europe. The euro and the struggle for the creation of a new global currency*. Firenze: Firenze University Press

Curran, D. (2009) *British Regional Growth and Sectoral Trends – Global and Local Spatial Econometric Approaches*. NIRSA Working Paper Series No. 49

Daban, T, Domenech, R. and Molinas, C. (1997) *International and Inter-temporal Comparison of Real Product in OECD countries. A Growth Sensitivity Analysis*. Review of Income and Wealth 43 (1), 33-48

Deaton, A. (1999) *Saving and Growth. The Economics of Saving and Growth: Theory, evidence and implications for policy* . Cambridge, UK : Cambridge University Press.

De Grauwe, P. (2016) *Economics of a Monetary Union. 11th Edition*. Oxford: Oxford University Press

De Grauwe, Paul and Ji, Yuemei (2018) *Core-periphery relations in the Eurozone*. The Economists' Voice

De Grauwe, P. and Ji, Y. (2016) *How to Reboot the Eurozone and ensure its long-term survival*. Vox CEPR's Policy Portal. Available online at: [http://voxeu.org/article/how-reboot-eurozone-and-ensure-its-long-term-survival] Accessed: 08th January 2010

De Grauwe, P. and Ji, Y. (2015) *Market sentiments and Sovereign Debt Crisis in the Eurozone*. FinMaP Working Paper No. 28

De Grauwe, P. and Ji, Y. (2014) *How Much Fiscal Discipline in a Monetary Union?* Bank of Greece Special Conference Paper the crisis in the euro area, May 23-24, 2013

De Grauwe, P. and Ji, Y. (2013a) *The Legacy of Austerity in the Eurozone.* CEPS Commentary, 4 October 2013. [Policy Paper]

De Grauwe, P. and Ji, Y. (2013b) *Panic-Driven Austerity in the Eurozone and its implications*. CEPR Policy Portal. Retrieved from: https://voxeu.org/article/panic-driven-austerity-eurozone-and-its-implications . Accessed:7th November 2019.

De Grauwe, P. and Ji, Y. (2013c) *The fragility of two monetary regimes: The European Monetary System and the Eurozone*. National Bank of Belgium Working Paper No. 243

DeLong, J. B. and Summers, L. H. (2012) *Fiscal Policy in a Depressed Economy*. Brookings Papers on Economic Activity 2012(1), pp. 233-297

DeLong, J. B. (1988) *Productivity Growth, Convergence and Welfare: a Comment*. The American Economic Review 78(5), 1138 – 1154

Dell'Ariccia, G.; Ferreira, C.; Jenkinson, N.; Laeven, L.; Martin, A.; Minoiu, C. and Diaz del Hoyo, A. (2018) *Managing the sovereign-bank nexus*. ECB Working Paper Series No. 2177

Dowrick, S. and Nguyen, D. T. (1989) *OECD Comparative Economic Growth 1950-85: Catch-Up and Convergence*. The American Economic Review 79 (5), pp. 1010-1030

Dukker, D. M.; Peng, H. and Prucha. I. R. (2013) Creating and managing spatial-weighting Matrices with the Spmat command. The Stata Journal, 13(2), pp. 244-286

Durlauf, S., P. Johnson, P. and Temple, J. (2005) *Growth econometrics*. In P. Aghion and S. Durlauf (eds.), *Handbook of Economic Growth*. Amsterdam: North-Holland

Durlauf, S. and Johnson, P. (1992) *Local versus Global Convergence across National Economies*. NBER Working Paper No. 3996

European Commission (2014) *Commission calls for immediate action for a European Industrial Renaissance*. European Commission Press Realise, Brussels, 22 January 2014

Farole, T., M.; Park, R. J. and Hooton, C. (2018) *Assessing the Economic Potential of Europe's Regions*. Washington, DC: World Bank.

Feldstein, M. and Bacchetta, F. (1991) *National Saving and International Investment*. In Bernheim, B. D. and Shoven, B. J. (1991) *National Saving and Economic Performance*. Chicago: University of Chicago Press

Feldstein, M. and Horioka, C. (1990) *Domestic Savings and International Capital Flows*. NBER Working Paper No. 3164

Feldriker, M. (2006) *Regional Convergence within the EU-25: A Spatial Econometric Analysis*. Workshops Proceedings of OeNB Workshops

Franks, J.; Barkbu, B.; Blavy, R.; Oman, W. and Schoelermann, H. (2018) *Economic Convergence in the Euro Area: Coming Together or Drifting Apart?* IMF Working Paper January 2018

Friedrich, C.; Schnabel, I. and Zettelmeyer, J. (2010) *Financial integration and growth. Is emerging Europe different?* EBRD Working paper No. 123

Friesenbichler, K. S. and Glocker, C. (2018) *Tradability and Productivity Growth Differentials Across EU Member States*. WIFO Working Papers 547, WIFO

Fürst, E., (2013) *Renaissance der Industriepolitik?*,ÖGfE Policy Brief 2013.

Godea, M. D. and Sanz Villarroya, I. (2016) *Testing the Convergence Hypothesis for OECD Countries: A Reappraisal*. Economics: The Open-Access, Open-Assessment E-Journal Vol. 11

Gomes Neto, D. and Veiga, F. (2019) *Financial globalization, convergence and growth: The role of foreign direct investment*. Journal of International Money and Finance, 2013, 37 (c), pp. 161-186

Giavazzi, F., Jappelli, T. and Pagano M. (1999) *Searching for non-Keynesian effects of fiscal policy*. CSEF, Centro Studi in Economia e Finanza, WP No 16, Università di Salerno, Italia,

Giavazzi, F. and Pagano, M. (1996) *Non-Keynesian Effects of Fiscal Policy Changes: International Evidence and the Swedish Experience*. Swedish Economic Policy Review, 3(1), 68-103

Giavazzi, F. and Pagano, M. (1990) *Can Severe Fiscal Contractions be Expansionary? Tales of Two Small European Countries*. NBER Working Paper No. 3372

Gilpin, R. (2001) *Global Political Economy. Understanding the International Economic Order*. Princeton: Princeton University Press

Greif, A. (1994) *Cultural beliefs and the Organization of Society. Theoretical reflection on Collectivist and Individualist Societies*. The Journal of Political Economy, 102 (5), pp. 912-950

Gros, D. (2018) *Convergence in the European Union: Inside and outside the euro.* Contribution by Daniel Gros, Director of CEPS Informal meeting of Economic and Financial Affairs Ministers Sofia, 27-28 April 2018. UNSPECIFIED

Gadea Rivas, M. D. and Villarroy, I. S. (2017) Testing the convergence hypothesis for OECD countries: a Reappraisal.

Gujardo, J. ; Leigh, D. and Pescatori, A. (2011) *Expansionary Austerity: New International Evidence*. IMF Working Paper No.158

Gugnasca, A. and Rother, P. (2015) *Fiscal Multipliers during Consolidation: evidence from the European Union*. ECB Workign Paper No.1863

Hamilton, L. C. (2005) Statistics with STATA. Boston, Massachusetts: Cengage Learing

Harris, R. (2008) *Models of Regional Growth: Past, Present and Future*. SERC Discussion Papers, SERCDP0002. Spatial Economics Research Centre (SERC), London School of Economics and Political Science, London

Harris, R. (2008) *Models of Regional Growth: Past, Present and Future*. SERC Discussion Papers, SERCDP0002. Spatial Economics Research Centre (SERC), London School of Economics and Political Science, London

Heimberger, P. (2016) *Did Fiscal Consolidation Cause the Double dip Recession in the Euro Area?* Vienna Institute for International Economic Studies Working Paper No.130

Held, D.; McGrew, A.; Golblat, D. and Perraton, J. (2010) Global Transformations. Politics, Economics and Culture. Cambridge UK: Polity Press

Helper, S., Krueger, T. and Wial, H. (2012) *Why Does Manufacturing Matter? Which Manufacturing Matters?* A Policy Framework, Brookings, February.

Hill, C. W. L. (2011) *International Business. Competing in the Global Marketplace*. New York: McGraw-Hill Irwin

Hox, J. (1998) *Multilevel models: When and Why*. In Mather, R.; Balderjahn, I. and Schader, M. (1998) *Classification, Data Analysis, and Data Highways*. Potsdam: Springer

Hsiao, C. (2006) *Panel Data Analysis - Advantages and Challenges*. Wise Working Paper Series No. 0602

Hsiao, C. (2005) *Why Panel Data?* IEPR Working Paper Series 0533

Hsiao, C. (2003) *Analysis of Panel Data. Second Edition*. Cambridge: Cambridge University Press

Huggins, R, and Thompson, P. (2017) *Introducing Regional Competitiveness and Development: Theories and Perspectives*. In Huggins, R. and Thompson, P. (2017) *Handbook of Regions and Competitiveness: Contemporary Theories and Perspectives on Economic Development*. Chaltam*:* Edward Elgar Publishing Limited

Igan, D.; Moussawi, H.; Tieman, A. F.; Zdzienicka, A.; Dell'Ariccia, G and Mauro, P. (2019) *The Long Shadow of the Global Financial Crisis: Public Interventions in the Financial Sector*. IMF Working Paper 19/64

Islam, N. (1995) *Growth Empirics: A Panel Data Approach*. The Quarterly Journal of Economics, 110 (4), pp. 1127–1170

Jarociński, M. and Maćkowiak, B. (2017) *Monetary-fiscal interactions and the euro area's malaise*. ECB Working Paper No. 2072

Kaldor, N. (1975) *Economic growth and the Verdoorn law*, Econ. J. 85, 891-896. The Economic Journal, 85(340), pp. 891-896

Kaldor, N. (1966) *Causes of the slow rate of growth in the United Kingdom*. Cambridge: Cambridge University Press

Kaldor, N. (1968) *Productivity and Growth in Manufacturing Industry: A Reply*. Economica, New Series, 35 (140), pp. 385-391

King, M. (2015) *The End of Alchemy. Money, Banking and the Future of Global Economy*. London: W. W. Norton and Company Inc.

Kondo, K. (2016) *Introduction to spatial econometric analysis: Creating spatially lagged variables in Stata*. Discussion papers 16901, Research Institute of Economy, Trade and Industry (RIETI)

Krugman, P. (2020) *Arguing with Zombies. Economics, Politics, and the Fight for a Better Future*. London: W. W. Norton and Company Inc.

Krugman, P. (2011) *The New Economic Geography, Now Middle-aged*. Regional Studies, 45 (1), pp. 1-7

Krugman, P. (2009) *Where in the World is "New Economic Geography?*. In Clark, G. L.; Feldman, M. P. and Gertler, M. S. (2009) *The Oxford Handbook of Economic Geography*. New York: Oxford University Press

Krugman, P. and Venables, A. J. (1995) *Globalization and Inequality of nations*. Quarterly Journal of Economics, 110(1), pp. 857-880

Krugman, P. (1994) *The Age of Diminishing Expectations*. Cambridge, MA: MIT Press

Krugman, P. (1993) *Lessons of Massachusetts for EMU*. In Torres, F. and Giavazzi, F. (1993) Adjustment and Growth in the European Monetary Union. Cambridge: Cambridge University Press

Krugman, P. (1991a) *Increasing Returns and Economic Geography*. Journal of Political Economy, 99 (3), pp. 481-499

Krugman, P. (1991b) *History and Industry Location: The Case of the Manufacturing Belt*. The American Economic Review, 81(2), Papers and Proceedings of the Hundred and Third Annual Meeting of the American Economic Association, pp. 80-83

Krugman, P. and Venables, A. J. (1990) *Integration and the competitiveness of peripheral industry*. CEPR Discussion Papers 363

Labaye, E.; Sjåtil, P. E.; Bogdan, W.; Novak, J.; Mischke J.; Fruk, M. & Ionuţiu, O. (2013*), A New Dawn: Reigniting Growth in Central and Eastern Europe*. London: McKinsey Global Institute Europe.

Lane, P. R. (2012) *The European Sovereign Debt Crisis*. Journal of Economic Perspectives, 26 (3), pp. 49-68

Larre, B. and Torres, R. (1991) *Is Convergence a Spontaneous Process? The Experience of Spain, Portugal and Greece*. OECD Economic Studies N. 16

Lee-Jones, K. (2018) *Best practices in addressing police-related corruption*. Transparency International

Littel, R. C.; Pendergast, J. and Natarajan, R. (2000) *Modelling covariance structure in the analysis of repeated measures data*. Statistics in Medicine 19(13), pp. 1793-1819

Lucas, J. R, (1988) *On the Mechanics of Economic Development.* Journal of Monetary Economics, 22, 3-42

Maas, C. J. M. and Hox, J. J. (2004) I*nfluence of Violations of Assumptions on Multilevel Parameter Estimates and their Standard Errors*. Computational Statistics and Data Analysis, 46(3), pp. 427-440

MacMullen, R. (1988) *Corruption and the Decline of Rome*. New Heaven: Yale University Press

Mankiw, N.G., Romer, D. and Weil D. (1992) *A Contribution to the Empirics of Economic Growth*. Quarterly Journal of Economics". 107(5), pp. 407-437

Marelli, E.; Parisi, M. L. and Signorelli, M. (2019) *Economic convergence in the EU and Eurozone*. Journal of Economic Studies 46 (7), pp. 1332-1344

Marelli M. and Signorelli, M. (2016) The euro, long-run convergence and the impact of the crises. In Beker V. and Moro, B. (2016) The European Crisis. Bristol: World Economics Association

Marelli, E. and Signorelli, M. (2010) *Politica Economica. Teorie, Scuole ed Evidenze Empiriche*. [Economic Policy. Theories, Schools of Thoughts and Empirical Evidences]. Torino: Giappichelli Editore

Martin, R . (2001) *EMU versus the regions? Regional convergence and divergence in Euroland*. Journal of Economic Geography, 1 (1), pp. 51–80,

Maudos, J.; Pastor, J. M. and Serrano, L. (2000) *Convergence in OECD Countries. Technical Changes, Efficiency and Productivity*. Applied Economics, 32 (1), pp. 757-765

Mankiw, N.G., Romer, D. and Weil D. (1992) *A Contribution to the Empirics of Economic Growth. Quarterly Journal of Economics*. 107(5), 407-437

Marelli, E. P., Parisi, M. L. and Signorelli, M. (2019) *Economic Convergence in the EU and Eurozone*. Journal of Economic Studies, 46 (7), pp.1-13

Mark, M. , Richeter, S. and Szemlér, T. (2015) Cohesion Policy as a Function of the EU Budget. A Perspective from CEE Member States. WIIW Research Report 400

Martin, R. and Sunley, P. (1998) *Slow Convergence? The New Endogenous Growth Theory and Regional Development*. Economic Geography, 74 (3), pp. 201-227

Mauro, P. (2002) *The Persistence of corruption and Slow Economic Growth*. The International Monetary Fund. IMF Working Paper No.02/13

Mauro, P. (1995) *Corruption and Growth*. The Quarterly Journal of Economics, 110 (3), pp. 681 – 712

Mazzucato, M. (2018) *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*. London: Penguin Books

McDermott, C. and Wescott, R.F. (1996*) An Empirical Analysis of Fiscal Adjustments*. IMF Staff Papers, 43 (4), pp. 725-753

Meyland, D. and Schäfer, D. (2017) *Risk weighting for government bonds: challenge for Italian banks*. DIW Economic Bulletin

Millo, G., & Piras, G. (2012*). Splm: spatial panel data models in R*. Journal of Statistical Software, 47(1), pp. 1-38

Mollino, L. and Sottillotta, C. (2020) *The Politics of the Eurozone Crisis in Southern Europe*. *A Comparative Reappraisal*. New York: Palgrave MacMillan

Moran, P. A. P. (1950) *Notes on continuous stochastic phenomena*. Biometrikam 37 (1), pp.17-23

Myro Sánchez, R. (2019) *A Policy for a New Industrial Revolution*. Economia e Politica Industriale: Journal of Industrial and Business Economics, 46 (3), pp. 403-414

North, D.C. (1991) *Institutions*. Journal of Economic Perspectives, 5 (1), pp. 971-112

Obstefeld, M. (1997) *Europe's Gamble*. Brooking Papers on Economic Activity 2:1997

Obstefeld, M. (1998) *EMU: Ready or Not?* NBER Working Paper 6682

O'Brein, R. (1992) *Global Financial Integration The End of Geography*. London: The Royal Institute of International Affairs

Ostry, J. D.; Ghosh, A. R. and Espinoza, R. (2015) *When Should Public Debt be Reduced?* IMF discussion paper June 2015

Özyurt, S. and Dees, S. (2015) *Regional dynamics of economic performance in the EU: To what extent spatial spillovers matter?* ECB Working Paper Series No. 1870/December 2015

Pagel, C.; Prost, A.; Lewyka, S. and Das, S. (2011) *Intracluster correlation coefficients and coefficients of variation for perinatal outcomes from five cluster-randomised controlled trials in low and middle-income countries: results and methodological implications*. Tirals, 12 (1)

Parello, C. and V. Visco (2012*) The European Redemption Fund: A Comparison of Two Proposals* Politica Economica, 28(3), pp. 273-306

Pasimeni, P. (2015) *The Economic Rationale for an EMU Fiscal Capacity*. European Commission: Directorate General for Employment, Social Affairs and Inclusion

Pelagidis, T. (2009) *Structural and Institutional Divergence in the European Union*. Challenge, 52 (6), pp. 101-113

Piton, S. (2017) *Economic Integration and the Non-tradable Sector: the European Experience*. 25th CEPR European Summer Symposium in International Macroeconomics (ESSIM) May 25th, 2017

Pons-Novell, J. and Viladecans-Marsal, E. (1998) *Kaldor's Law and Spatial Dependence: Evidence for the European Regions*. Regional Studies, 33 (5), pp.443-451

Porter, M. E. (2009) *Locations, Clusters and Company Strategy*. In Clark, G. L.; Feldman, M. P. and Gertler, M. S. (2009) *The Oxford Handbook of Economic Geography*. New York: Oxford University Press

Rabe-Hesket, S. and Skrondal, A. (2012) Multilevel and Longitudinal Modelling using Stata. Volume I, Third Edition. College Statio, Texas: StataCorp LP

Ravenhill, J. (2011) *Regional Trade Agreements*. In Ravenhill, J. (2011) *Global Political Economy*. *Third Edition*. Oxford: Oxford University Press

Reuters (2016) *Banche, Padoan: effetti destabilizzanti da tetto a titoli Stato*. 13th May 2016 [Banks, Padoan: Destabilising Effects from the upper roof to government bonds]

Reuters (2011)

Rehn, O. (2018) *Europe, EMU and Banks*. Keynote speech by Mr Olli Rehn, Deputy Governor of the Bank of Finland, at the Italian Banking Association, Rome, 14 May 2018.

Reiner, C., (2012) *Play it again. Sam: die Renaissance der Industriepolitik in der Großen Rezession*. Wirtschaft und Gesellschaft, 38(1), pp. 15-56.

Ridao-Cano, C. and Bodewig, C. (2018) *Growing United. Upgrading Europe Convergence Machine*. International Bank for Reconstruction and Development / The World Bank

Rodriguez-Pose, A. and Ketterer, T. (2019) *Institutional change and development in lagging regions in Europe*. CEPR Policy Portal. Retrieved from: https://voxeu.org/article/institutional-change-and-development-lagging-regions-europe. [Accessed: 27th December 2019]

Rodríguez-Pose, A., and Di Cataldo, M. (2014). Quality of government and innovative performance in the regions of Europe. *Journal of Economic Geography*, 15(4), 673-706

Rodrik, D. (2013) *Unconditional Convergence in Manufacturing*. The Quarterly Journal of Economics (2013), 165–204

Rodrik, D. (2011) *The Manufacturing Imperative*. Project Syndicate, 10th August 2011. Retrieved from: https://www.project-syndicate.org/commentary/the-manufacturing imperative?barrier=accesspaylog. [Accessed: 5th May 2019]

Rodrik, D. (2007) *One Economics. Many Recipes. Globalization, Institutions and Economic Growth.* Princeton: Princeton University Press

Rodrik, D.; Subramianan, A. and Trebbi F. (2002) *Institutions Rule: the Primacy of Institutions over Geography and Integration in Economic Development.* NBER Working Paper No. 9305

Rowthorn, R. and Ramaswamy, R. (1997) *Deindustrialization–Its Causes and Implications*. International monetary Fund Working Paper No. 97/42

Romer, P. M. (1986) *Increasing Returns and Long Run Growth*. Journal of Political Economy, 94, 1002–37

Rother, P.; Schuknecht, L. and and Stark, J. (2010) *The Benefits of Fiscal Consolidations in Uncharted waters*. European Central Bank Occasional Paper No. 121

Rothstein, B. and Uslaner, E. M. (2005) *All for All: Equality and Social Trust*. LSE Health and Social Care Discussion Paper No. 15

Rutherford, M. (2001) *Institutional Economics: Then and Now*. Journal of Economic Perspectives, 15 (3), pp. 173–194

Sala-i-Martin, X. (1996) *The Classical Approach to Convergence Analysis*. Economic Journal, 106 (437), pp. 1019-1136

Savage, D. J. (2001) *Budgetary Collective Action Problems: Convergence and Compliance under the Maastricht Treaty on European Union*. Public Administration Review, 61 (1) , pp. 43-53

Sachs, J. D. and Warner, M. A. (1995) *Economic Convergence and Economic Policies*. NBER Working Paper No.5039

Sala-i-Martin, X. (1996) *The Classical Approach to Convergence Analysis*. The Economic Journal, 106 (437), pp. 1019-1036

Solow, R. M. (1956) *A Contribution to the Theory of Economic Growth*. The Quarterly Journal of Economics, 70 (1), pp. 65-94

Sondermann, D. (2019) *Economic structures 20 years into the euro*. ECB Occasional Paper

StataCorp. (2017). *Stata: Release 15 Statistical Software*. College StationTX: StataCorp LLC.

Steinbach, A. (2015) *The Mutualisation of Sovereign Debt: Comparing the American Past and the European Present*. Journal of Common Market Studies, 53 (5), pp. 1110-1125

Stock, J. H. and Watson, M. W. (2012) *Introduction to Econometrics*. New York: Pearson Education

Stollinger, R. (2016) *Structural Change and Global Value Chains in the EU*. The Vienna Institute of International Economic Studies, Working Paper N.127

Stollinger, R.; Hanzl-Weiss, D., Leitner, S. and Stehrer, R. (2015) *Global and Regional Value Chains: How Important, How Different?* The Vienna Institute for International Economic Studies, Research Report 427

Stollinger, R, McGregor.F; Holzner, M.; Landesmann, M.; Pöschl, J. and Stehrer, R. (2013) *A 'Manufacturing Imperative' in the EU – Europe's Position in Global Manufacturing and the Role of Industrial Policy*. WIIW Research Reports No. 31 October 2013

Tanzi, V. and Zee, H. H. (1997) *Fiscal Policy and Long-Run Growth*. IMF Staff Papers Vol. 44, No. 2 (June 1997)

Temple, J. (1999) *The New Growth Evidence*. Journal of Economic Literature, 37(1), pp. 112-156

Tobler W., (1970) *A computer movie simulating urban growth in the Detroit region*. Economic Geography, 46 (Supplement), pp. 234–240

Venables, J. A. (2009) *New Economic Geography*. The New Palgrave Dictionary of Economics

Verdoorn, P. J. (1949) *I Fattori the Regolano lo Sviluppo della Produttività del Lavoro*. [Factors that regulate the development of Labour Productivity]. L'Industria

Veugelers, R. (2017) *Remaking Europe: the new manufacturing as an engine for growth*. Bruegel Blueprint Series No.26

Wall Street Journal (2016) *Italian Finance Minister Calls for Caution on Eurozone Financial Reforms*. 24th January 2016. Retrieved from: https://www.wsj.com/articles/italian-finance-minister-calls-for-caution-on-eurozone-financial-reforms-1453627257 . [Accessed: 14th January 2019]

Zingales, L. (2014) *Europa o No. Sogno da realizzare o incubo da cui uscire*. [Europe or Not. A dream to bring to fruition or a nightmare to flee from]. Milan: Rizzoli